THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

1906 Edition

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ANOMALIES IN THE WORKMEN'S COMPENSATION ACT.

Two cases under the Workmen's Compensation Act, 1897, of which the facts are extremely simple, but which involved questions of considerable importance to manufacturers, have recently been decided in the House of Lords. In the first of these the question was—what constitutes "serious and wilful" misconduct which, as our readers are probably aware, disentitles a workman from receiving compensation under the Act? One, Johnson, was employed by Marshall, Sons & Co., the well-known manufacturing engineers, of Gainsborough. They had on their premises a lift or hoist on which was posted a notice that it was only to be used by workmen when in charge of goods. On the day the accident happened Johnson got into the lift in order to pass quickly from one floor to the other, and, as he was leaving it, owing to some unexplained cause, the lift suddenly moved upwards. He was thrown down, and crushed between the floor of the lift and the top of the doorway, and so injured that he died three days afterwards.

In these circumstances it was contended in the County Court on the part of the company, who resisted a claim for compensation, made by Johnson's widow, that inasmuch as he broke the rule he had been guilty of "serious and wilful" misconduct, and was not entitled to compensation. The County Court Judge and the Court of Appeal both took this view (Lord Justice Matthew dissenting), but the House of Lords has now reversed the Court of Appeal, holding, in effect, that there was no serious and wilful misconduct! The Lord Chancellor said: "I disagree with the view that the word 'serious' can be construed in reference to the result of the misconduct, for I think it clearly qualifies the misconduct itself. . . . . If that view is right it cannot be contended that using the hoist as a 'passenger' lift—when the evidence is that this is commonly done—renders the breach of the rule by the workman an act of serious and wilful misconduct within the Act."

Lord Justice James said: "The man had no reasonable expectation that using the lift would be dangerous. It is true that there are circumstances in which a perfectly innocent act might be regarded as serious; for example, if in breach of a rule, a miner struck a match in the mine to light his pipe. On the other hand, breach of a rule to 'keep off the grass' could not be regarded as serious and wilful misconduct." Accustomed as we are to seeing the Workmen's Compensation Act decided in favour of the men, we confess to a difficulty in understanding this decision.

Surely, if other men used that lift—this was commonly done—they were all guilty of "serious and wilful misconduct," and the responsibility of, or excuse for, the man who was caught in his own trap, as it were, is not lessened by the fact that others were *in pari delicto*. Lord James, to the non-legal mind, appears to take an

extraordinary view. Why go out of his way to defend—for that is the plain English of it—the man's wilful act, when his employers post up a notice that he must not use the lift as passenger? It was not a question of whether the man thought there was danger or not. Railway companies put up a notice that "passengers must cross the line by the foot-bridge"; they do not tell him *why*, so if he chooses to go across the permanent way and get "chawed up" by a passing train, his relatives do not get compensation for his indiscreet act.

While we are inclined to agree that a breach of the rule to "keep off the grass" should not be regarded as serious, we respectfully dissent from the view that to use a dangerous machine like a lift in contravention of the rules is an offence which can be lightly passed over. We admit that it is a question of degree in each case; but we should prefer to adopt the opinion expressed by Lord Atkinson, who came to the conclusion that the appeal should be allowed, with some doubt, because of the necessity that existed in factories of rules being rigidly enforced.

Coming to the next case—Back *v.* Dick, Kerr & Co.—the House of Lords were asked to consider the meaning of the phase "on, in, or about" an engineering work. The company were taking up tram rails. Back, with other men, was unloading new rails from a truck in a siding at a railway station 700 yards away from the point where the rails were being taken up. While so engaged, he met with an accident. Question: Did it occur on, in, or about an engineering work? The County Court Judge made an award in favour of the applicant, which was set aside by the Court of Appeal, and the Court of Appeal have been affirmed in the House of Lords by a majority of one. To the man in the street there would seem to be very little doubt about the matter—the phrase engineering work ought, it is conceived, to include everything carried on within a reasonable distance which is incidental to the main objects of the job which is on hand. Had Back been a railway servant, or the servant of a carrier, one could have understood it; but the man in the street would surely conclude that he was Dick, Kerr's man engaged upon a part of Dick, Kerr's engineering operations. Lord Robertson took the view that the stacking of rails was incidental to the carrying out of the work, and compared it to the leaving of goods at a cloak room.

We fail to see the analogy of the cloak room. A passenger depositing an article in a cloak room is not in the service of the railway company. He pays for the privilege of leaving it there, he is not liable to accident when removing it, and even if he were, he would be acting on his own responsibility.

If a railway station in which the rails are stacked is outside the protecting zone, then surely any portion of a roadway which is to have electric trams, but on which the rails *have not yet been laid*, is equally outside the protecting zone; yet if a man met with an accident in unloading the rails 20 yards beyond where the laying of the rails is progressing, would that point be called outside the protecting zone? The fact of the rails being in a railway station yard seems to us to have no particular bearing on the matter; they were being unloaded and stacked again by Dick, Kerr's employés, and therefore, presumably in Dick, Kerr's possession, and were being moved in connection with that firm's engineering work, and the man was "on or about" that work.

Suppose in a street, say ¼ mile long, rail laying was commenced at one end, and at the other end some rails were stacked for convenience; if a contractor's man happened to tumble over these rails one day and severely injured himself, would that spot where the accident happened be outside the protecting zone? The non-legal mind would reply, not exactly!

We have drawn attention to these two cases at some length with a view to demonstrating how hopelessly illogical are the decisions of the Courts under the memorable Act of 1897. In one case where the employers had made a rule for the protection of their men, they are held liable because one of their men broke that rule; in another case, where a man broke no rule, and obviously suffered while engaged in his master's business, the employers are excused! If the Amendment Bill now before the House of Commons did nothing else but remove these extraordinary anomalies, it would have our heartiest support.

The Best Material for Brake-Blocks.

Fifteen gentlemen are good enough to give their opinions on this subject in a recent issue of the *Light Railway and Tramway Journal* in reply to a question asked anonymously in the previous issue, and very interesting reading they provide, so long as the reader knows enough to be critical; for the fifteen divide themselves into no fewer than four different sides, and it is fairly obvious that all cannot be supporting the right.

The choice seems to lie between soft cast-iron, shallow-chilled, deeply-chilled, and hard grey or common iron; but why anyone who thinks that a chilled surface is best should limit the depth of the chill to a small fraction of the wearing depth is difficult to understand. If chilling is right in principle and practice, it ought to be carried to the extreme depth, but it is almost impossible to imagine that it can be as good as soft or ordinary iron for its purpose.

In fact, the choice of the hardest material arises probably from some confusion of ideas, the upholders of this choice thinking rather of the life of the brake-block than of the braking effect. The gentlemen whose replies show that they have gone into the whole question with clear and open minds, express no doubt that the life of the block varies with its hardness, as might be expected; while the braking effect is diminished as the hardness increases, which also is not surprising.

To reduce the control of the car for the sake of getting a few weeks' extra life from material which costs, at the outside, 10s. per four-wheeled car is nothing short of folly, and there should be no extenuation of cheese-paring carried to such a degreee.

The primary object of brake-shoes is to brake, and, considering its vital function, the material which will allow this to be done in the most efficient way is the only one that ought to be used.

The use of chilled blocks against chilled wheels cannot be condemned too severely on the ground of safety, and apart entirely from any question of half-farthings; while with the relatively more expensive steel tires a block which is softer than the tire probably is better than a chilled block, both economically and from the higher view. The statements made by two of the seven who use chilled blocks that the wheels do not wear more quickly in consequence should be taken with much caution, especially as they are contradicted by several of the other contributors, who appear to have given at least as much attention to the point.

When all is done the very economy of the chilled block is in grave doubt, for quoting from a reply in which their use on tired wheels is upheld, "the life of the chilled block compared with the ordinary cast-iron block was as 2·48 to 1, whilst the price . . . was as 2·26 to 1."

One gentleman objects to soft blocks because they skid the wheels more easily than the chilled blocks, evidently preferring to throw away the more efficient agent rather than to train his drivers or to adjust his brake-gear.

Reason is all on the side of the softer material, and just when everyone is clamouring for higher speeds, and either

getting or taking them, it is of the first importance that nothing should be done to reduce the available braking power below the maximum possible.

Electrical Smelting of Iron Ore in Canada.

A PAPER was read recently before the Canadian Club of Toronto by Dr. Eugene Haanel, Superintendent of Mines in Ottawa, in which the author discussed the results of the experiments carried out a short time ago under the auspices of the Canadian Government, and the supervision of Dr. Héroult, upon the feasibility of smelting Canadian ores electrically with the aid of charcoal.

It will be remembered that the experiments performed in Europe some time back before the members of the Canadian Commission left several points to be elucidated, because they did not show whether or no magnetite (the principal Canadian ore) could be smelted as successfully as hematite, whether an ore rich in sulphur would yield a pig of merchantable quality, whether native wood charcoal could be used as successfully as the more expensive imported coke, and what would be the exact amount of pig produced per unit of electrical energy consumed. In these circumstances, as we have already mentioned, the Canadian Government finally decided to make "an appropriation" for the purpose of having fresh experiments instituted under precise Canadian conditions, the Lake Superior Power Co., of Sault Ste. Marie, offered a building and the use of a 300-H.P. alternator, and Dr. Héroult, then in Canada, undertook to superintend the trials.

A furnace was erected, and from the middle of last February to March 5th, about 150 casts were made, which yielded roughly 55 tons of pig-iron. At first hematite, such as is employed in ordinary blast furnaces, was reduced, but afterwards different classes of Canadian magnetites from different localities were tried—all of the latter except one being of high sulphur content. The reducing agent was charcoal, which allowed the furnace to work quietly and regularly, and caused the electrode to require but little attention. The results showed that, although the slag was not particularly basic, all the sulphur could be made to pass into it, the pig containing only a few thousandths of 1 per cent. of sulphur; and the output was much greater (sometimes by one-third) than the figures adopted by Mr. Harbord in the Government report.

Further experiments were carried out on some roasted and briquetted nickelliferous pyrrhotite containing 1·6 per cent. of sulphur. This yielded a metal containing 4·5 per cent. of nickel and only about 0·006 per cent. of sulphur, possessing an estimated value of $40 to $44 per ton. The consumption of electrodes was between 15 and 20 lb. per ton of pig, allowance being made for the wastage that occurs when exposed to air in an incandescent state for many hours, and when used for melting down the charges. Héroult states that electrodes can be manufactured by his process at 1·5 cents per lb., *i.e.*, 30 cents per ton of pig, instead of 77 cents as estimated in the report of the commission.

Dr. Haanel regards these results as most satisfactory. A blast furnace will not usually take an ore containing more than 0·1 per cent. of sulphur; and so suitable hematite costs in Canada sometimes as much as $4.50 per ton. A lower grade ore rich in sulphur, which nevertheless yields in the electric furnace as good a pig as the former when reduced metallurgically, can be purchased for $1.25. Among other advantages of the electrical smelting of iron ores from a Canadian point of view, Dr. Haanel mentions that the amount of silicon can be varied as required for the class of pig to be produced. Charcoal made from mill or wood refuse, or peat coke made from the abundant deposits in Ontario and Quebec, can be used quite successfully, and there is no need to briquette the charcoal or peat coke with the ore. Burnt iron pyrites, the by-product in making sulphuric acid, now a waste material, can be smelted into metal in the electric furnace. Since one ore containing 35 per cent. of titanic acid gave a pig of passable quality (judging from its fracture), titaniferous ores containing up to 5 per cent. should be available for reduction.

Parliamentary Procedure.

Is it not quite time that some entirely different method of procedure should be followed in the getting of Parliamentary powers for the carrying out of industrial schemes? At present the promoters of a scheme have to appear before a Committee of members of one of the Houses of Legislature. The members of this Committee are no doubt men of ordinary intelligence, it may even be conceded that they are men of superior intelligence, but they are usually quite unacquainted with the technicalities of the projects put before them, and what is worse, the arguments of the promoters can only be put through the mouth of a member of the Parliamentary Bar, who is equally as incapable as the Committee of grasping the significance of the arguments on which a scheme is based. The result often is, as must have been found by promoters, that points of no importance are taken up seriously by the Committee, while points of great importance fail to impress them.

We have seen Counsel, in his want of knowledge, place the most important matters in an entirely wrong aspect before the Committee, and a strong Chairman, thus getting hold of quite wrong impressions, refuse to be put right by witnesses' statements.

The Chairman carries all his colleagues with him in insisting on clauses which are both foolish and impossible, and, at one blow, the whole value of the project is destroyed by one foolish little clause. Promoters and witnesses spend days uselessly in the lobby waiting for their turn. Counsel, whom they pay, appear or they don't appear, just as it may please them; they bully their employers, and will not listen to reason, or are incapable of understanding it. When they finally get before Committee they frequently go quite wrong in the way they handle witnesses, and display the most lamentable want of grasp of their subject. Promoters are harassed and fooled about, and nobody seems to be able to help it. This is just what might be expected from the explanation of any scheme by a layman to any body of laymen, while experts have to stand idly by to be ridden over roughshod by men lacking in essential knowledge. What would happen if such methods were followed in any other walk of life?

It is a disgrace to our methods that only through an ignorant mouthpiece can a case be presented, and then only to a body of men who are quite unfitted by training and experience for the position they occupy. Thousands of pounds are wasted in this way, and whether a scheme goes through or does not go through depends in no way upon its merits.

Protest ought also to be made over the custom far too much indulged in by counsel of making misstatements of facts after it is too late to call rebutting evidence. The idea of a Committee being set to hear promoters is to get at facts, but the method of procedure favours the most barefaced untruths and skilful juggling in words such as will mislead the Committee. The whole system is rotten; it is a survival of an old custom that may once have been perfectly sane and legitimate. It is particularly hard on provincial promoters to be put to the expense of visits to London for business that could better be handled locally, and we have not the slightest hesitation in stating what is a matter of common knowledge, that a very large proportion of vexatious opposition which is now brought forward against Bills would never be heard of, if it were not for the fact that opponents are desirous of coming to London on, to them, a cheap holiday; for such opposition is usually that of local authorities whose representatives come up at the ratepayers' cost, and perhaps get nothing more than a clause, which they could have got from the promoters by asking for it at home. They get it in Committee and go home from a holiday they need never have undertaken. This is how they serve the interests of their towns, and secure at an expense of much money, what need not have cost them a sovereign to obtain. Meantime, industry flags, pioneer work is not undertaken, or if undertaken is crippled by vexatious enactments, and all this is the result of lawyer-made law, for it is only too obvious that all the trouble is laid on for the benefit of legal monopolists. Why should it be necessary to put a lame half-told tale before a lay committee? It should be possible for promoters, business men and engineers to present their own business to a body of men capable of understanding it, to a committee of their peers, in fact, so that commonsense and technical necessities might have due play

METHODS OF METERING FOR ELECTRIC SUPPLY.

By ROBERT HORNBY.

It may be taken that any additional apparatus is worth the cost if, by its employment, an increase of consumption can be secured at paying rates.

Among other determining factors, the factor of time during which the installation is made use of, is the most important one, to the writer's mind.

The peak can be dealt with in two ways, to discourage or attempt to diminish the consumption during the peak period; or, and perhaps a better way, is to level up the load curve and so diminish the relative height of the peak.

Why not then make the cost of energy in *particular cases* bear some relation to the length of time of use?

An hour-meter will determine the hours of use, and a scale of charges could be based on something after the following:—

Average hours use per day.	Price.
Say 2 hours	Maximum
„ 4 „	Less 15 per cent.
„ 6 „	„ 25 „
„ 8 „	„ 50 „

The percentage reduction may be varied to suit particular or local conditions.

Energy bills would then be made out on the basis of—

$$\frac{\text{Hour-meter reading}}{91} = \text{average hours used per day per quarter.}$$

The steps might be known as tariff 1, 2, 3, and so on, with a definite charge set out for each.

It is not advocated that hour-meters should be used for any and every consumer, but certain classes of consumers, such as retail stores, having small workshops attached, butchers, cobblers, &c., also houses, flats and offices, where combined electric lighting, heating or cooking apparatus would prove a great convenience, and be readily adopted if the electrical energy required were reasonably cheap.

Such possible consumers can hardly be ranked and classed as power consumers in the same way as works and other really large consumers of power; yet, in the aggregate, the added small loads may be as valuable to the station as one large and purely power consumer. If such small and intermittent domestic power consumers—as they may be termed—were provided with an hour-meter costing under 30s., the hour-meter being put in series with the ordinary meter, and the scale of charges being arranged as indicated above, they would be encouraged to use electricity for every purpose where at all practicable, so extending the field of electric working.

Who amongst us, who know the many ways in which electricity may be so usefully and conveniently applied, has not at times, when confronted with a possible opening, regretted that its use is so largely neglected or may be, unknown.

The writer recently noticed a little cobbler's shop, from which proceeded the cheerful hum of a small motor driving a sewing machine, brushes, &c., revealing the fact that here was electricity helping the cobbler to sole people's boots with less labour and more speed than formerly.

Why cannot such instances be multiplied all over the country? Is it that energy cannot be sold cheaply enough, or is it not rather the want of a system of charging, where the selling price bears a relation to the cost of production?

Given a little encouragement by the opening of a possible market, manufacturers and firms would not be far behind in providing current-consuming apparatus for all manner of purposes, and the increased field would mean, in the end, cheaper and profitable prices both for current and current-consuming apparatus.

Electric Cranes for Railway Warehouses.—Messrs. C. and A. Musker (1901), Ltd., of Liverpool, have been awarded the contract for a 12-ton electrically-driven crane for the Huskisson goods station at Liverpool of the Cheshire Lines Committee.

THE ADVANTAGES OF THE INTER-POLE DESIGN IN RAILWAY MOTORS.*

By G. HERBERT CONDICT.

The Electro-Dynamic Co., of Bayonne, N.J. has made such a great success of the inter-pole type of motor for stationary purposes, that it has been decided to enter the electric railway field with a railway motor embodying the inter-pole features. A number of tests have recently been made by the Company of motors designed for this work, and most encouraging results have been secured. It has been demonstrated beyond all question that the inter-pole type of railway motor is far in advance of anything that has heretofore been brought out in direct-current practice. The motor excels particularly in the following features:—

1. The motor is absolutely sparkless under all conditions of operation up to voltages as high as 2,000. There is no doubt that the voltage can be raised to a much higher figure even than 2,000 volts; the only limit is the question of insulation.

2. A much greater flexibility in speed regulation can be secured. This is owing to the fact that the motor will operate satisfactorily

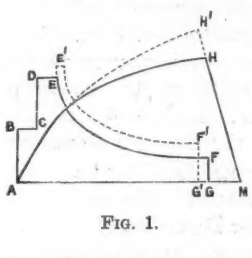


Fig. 1.

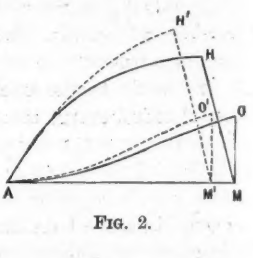


Fig. 2.

with its fields weakened to almost any extent. In the tests mentioned, motors of 40-h.p. capacity have been run with only 8 per cent. of their normal fields at 200 per cent. overload, with absolutely no sign of a spark.

3. In the inter-pole railway motor, a much greater torque per ampere can be obtained for a given amount of material, owing to the fact that more conductors may be placed upon the armature than in the ordinary type of railway motor for a given field strength.

4. For a given service, the inter-pole motor may be made much smaller than a motor of any other type, or, conversely, a much larger output can be secured from a given size of motor. To cite a specific example, in the design of a 200-h.p. railway motor, for high-speed trunk line service with high voltages, it has been possible to increase the track clearances to about three times what they would be with an ordinary railway motor of equal capacity.

5. As high voltages can be used, much lower cost of installation results, as less copper is used in the transmission circuits. This also allows of the use of a multiple-voltage system on electric railways. Low voltages can be used in towns and cities, and other places where low speed is desirable, and high voltages in suburban districts where high speeds are allowable. This advantage is secured with a single controlling equipment.

To illustrate in a graphical way some of the advantages secured from the use of the inter-pole railway motor, several diagrams are presented herewith, and illustrate the following features:—

Fig. 1 is a speed-time curve of the usual form, and shows that higher average speeds can be made without increasing the starting currents and braking pressures. It will be noted in this curve that

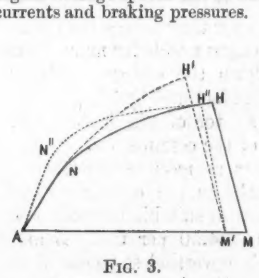


Fig. 3.

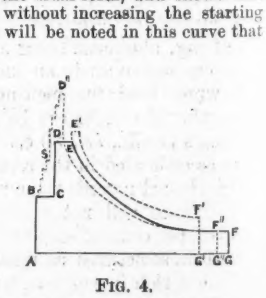


Fig. 4.

the full line, A H, represents the speed secured from an ordinary railway equipment, while the line A H' shows the speed curves with the inter-pole motor. As will be seen, higher average speeds may be secured with the inter-pole motor with the same rates of acceleration and retardation, that is, a greater distance may be travelled in a given time.

Fig. 2 is a diagram which shows that, with a given acceleration and a fixed rate of braking, a given distance can be covered in a shorter time. The distance M O is covered in the time A M by the ordinary equipment and in the shorter time A M' by the inter-pole equipment. When it is desired to make up time with the ordinary equipments, it is necessary to increase the rate of acceleration and also the rate of retardation.

In fig. 3 it will be noted that the inter-pole equipment, with the same rates of acceleration and retardation as in ordinary running,

* *Street Railway Journal*, April 21st, 1906.

will make up time without causing discomfort to the passengers or subjecting the apparatus to the great strains due to increased acceleration and retardation which would occur in the operation of the ordinary equipment. In this figure A N" H" M' represents the make-up time conditions with the latter type of equipment, while A N H' M' represents the conditions with the inter-pole equipment.

Fig. 4 shows the power required to make up time in runs where the accelerating and braking periods form the larger part of the running time. The extra power required is furnished at more efficient positions of control with the inter-pole type of equipment.

An interesting diagram is shown in fig. 5, where it will be noted that the same schedule speeds may be made with smaller starting currents and lower brake pressures with the same amount of energy consumption. From this diagram it will also be noted that the maximum load, as well as the variation of load on the power house, will be less for a given schedule speed if inter-pole equipments are used.

The advantages cited above are more apparent the longer the run. In a specific case for which calculations have been made for a double equipment of 40-H.P. inter-pole motors on a 17-ton car, a saving of 25 per cent. in energy was found to be possible in a one-mile run,

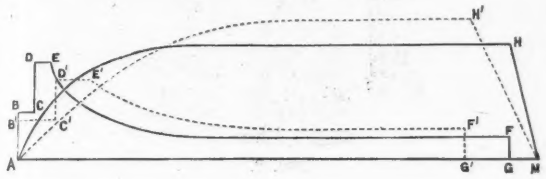


Fig. 5.

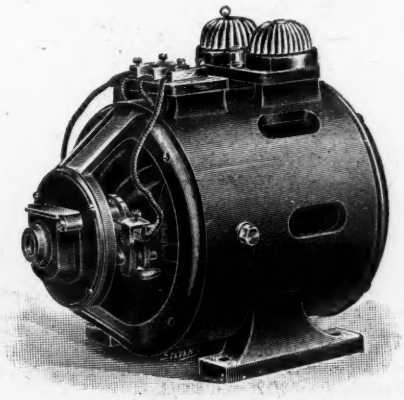
retaining the same schedule that was made with ordinary motors. The possibility of operating the motors with weakened fields allows of a saving in energy, from the fact that very much less resistance in the parallel positions will be used in getting the motors up to full parallel running position. This is an advantage which will show more particularly in short runs, or where the controller is thrown on and off frequently.

The Electro-Dynamic Co. will soon give out for publication its designs of high-speed railway motors, fitted with inter-poles and especially designed for trunk-line service, as well as curves, data, figures and weights, all of which will prove of great interest, and will show what a revolution is being produced by the use of the inter-pole design in this class of railway service.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Small Transformers.

We illustrate a new type of alternating to continuous current transformer for motor garage battery-charging and for electro-plating. For some time the Crypto Electrical Co. have been making such a machine, but it has been composed of an alternating current motor mounted on a cast-iron base-plate and coupled to a



Crypto Transformer.

dynamo. In the present instance they have done away with the base-plate, coupling and one pair of bearings, and the rotor of the motor is built on the same shaft as the armature of the dynamo. This renders the machine more efficient, owing to it being shorter in length, and owing to the elimination of one pair of bearings; it also has the advantage of making the machine much more compact, its dimensions being only 15 in. × 13 in. × 11 in. At present the machine is only being made in one size, namely, with an output of 100 watts on the secondary. The primary can be wound for single, two or three-phase, any voltage and periodicity.

Army-Service Telephones.

From the International Electric Co., of 55 Redcross Street, E.C., we have received a 30 pp. booklet, containing an English revised edition of an article by Major Ramdohr, late R.E. (German Army) on "Field Telephony." In the course of his notes, the writer refers to the necessity of keeping down the weight of hand telephones for field service. The telephone forms the main item in the weight of the whole system, and therefore when aluminium is extensively used for the outer metal cases

Fig. 1.

Fig. 2.

of the microphone and telephone and the tubular handle, the magnetic apparatus can be made correspondingly heavier, and hence more powerful. A hand apparatus is illustrated in fig. 1. The ear-piece is provided with an additional rim of leather or felt to prevent extraneous noises from disturbing the distinct hearing. Loud-speaking telephones in box form, where all the apparatus is firmly mounted in a case, can be fitted with heavier magnetic systems. A good deal of attention is devoted to the "Artillery" loud-speaker. It has an aluminium frame covered with leather as the receptacle for the microphonic outfit minus the battery. The microphone is fixed to one of the movable walls of the box, folding

Fig. 3.

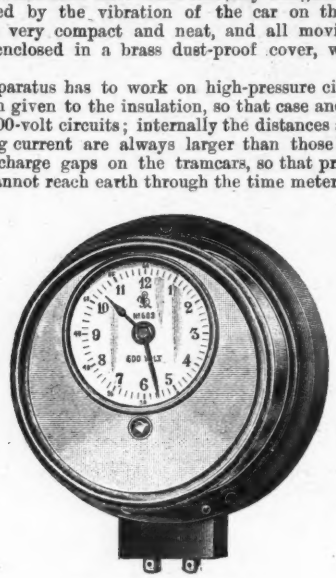
into the latter when out of use, whereby its mouthpiece telescopes into the funnel of the receiver, which is fixed to the opposite wall of the interior of the box. In fig. 2 we show this "Artillery" loud-speaker, in conjunction with a "Zeiss" stereo-telescope, usually employed for observation service, and for directing the firing line. The telephone has to establish connection between the observation line and the firing battery. The officer in command is thus enabled to communicate his instructions without intermediary or loss of time, direct to the firing battery. It is stated that the efficiency of this portable outfit can be materially enhanced when secondary or stationary batteries are admissible, as is the case within fortresses, &c.; and it is claimed to work equally well over thin temporary lines rigged up overnight, or on the heavy cables generally to be met with in fortifications. In regard to line material, both plain bronze wire on light poles and field cables of various sectional areas and weights are used. With the former a skilled *personnel* is required for its erection, with special wagons for the transport of poles; in other words, it would be only of use to a special field telegraph troop. A cable, however, can be payed out on to the ground or over tree-tops, and similar supports, by anybody. In fig. 3 is illustrated a shafted cable drum, with 1,000 metres of heavy field cable ready for use. There is a great deal of interesting matter and many appropriate illustrations in this brochure, a copy of which should be obtained by those who are particularly concerned with this department of electrical activity.

Tramcar Time Meter.

We learn that the "Time Meter" described in our issue of May 11th is made by Messrs. Hartmann & Braun, who are represented here by the Union Electric Co. The meter is illustrated herewith; the clock face is used instead of a train of dials, because anybody can read a clock correctly, whereas it is easy to err in reading dials.

The time meter contains an electro-magnet which attracts an armature when current is passing, thus releasing and giving the starting impulse to a high-class clock movement. The clock is spring-driven, and runs about 300 hours with one winding. The balance wheel and staff have been carefully designed, so that they are unaffected by the vibration of the car on the road. The apparatus is very compact and neat, and all moving parts are completely enclosed in a brass dust-proof cover, which can be sealed up.

As the apparatus has to work on high-pressure circuits, special care has been given to the insulation, so that case and base can be earthed on 600-volt circuits; internally the distances apart between parts carrying current are always larger than those between the lightning discharge gaps on the tramcars, so that pressures up to 4,000 volts cannot reach earth through the time meter.



Tramcar Time Meter.

The series resistance is arranged to suit the working pressure, the total resistance of the instrument for a working pressure of 600 volts being approximately 25,000 ohms; the power taken by the meter at 500 volts is approximately 10 watts.

The electro-magnet is wound as a pressure circuit in parallel with the car motor circuit, so that the full line pressure is available for starting the clock. The release action has sufficient range to work with certainty down to 350 volts pressure, if wound for 600 volts. The instrument can be supplied for either direct or alternating current.

At the tenth general meeting of the Tramway Associations of Germany, the Frankfort authorities reported that the use of this meter had led to a reduction of approximately 13 per cent. in the energy required on the line, and considerable economies on tires and brake blocks; in addition, the schedule running times were more strictly adhered to.

Wooden Electric Light Fittings.

We recently paid a visit to the showrooms of Messrs. Ellwood and Sledmere, 53, Mortimer Street, Cavendish Square, W., for a look round among their various designs of electric lighting fittings

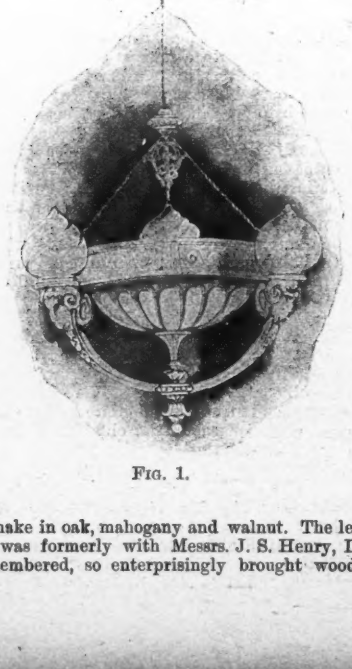


Fig. 1.

which they make in oak, mahogany and walnut. The leading spirit in the firm was formerly with Messrs. J. S. Henry, Ltd., who, it will be remembered, so enterprisingly brought wooden electric light fittings before the trade several years ago. Messrs. Ellwood and Sledmere have issued a catalogue containing many excellent designs of pendant, bracket, standard, and electrolier fittings, a couple of which we have selected for illustration here. Fig. 1 represents a three-light Adams flambeau, which is supplied painted white with compo enrichment.

The same design is also supplied for four and five lights. A neat example of a two-light bracket appears in fig. 2. The firm's show-

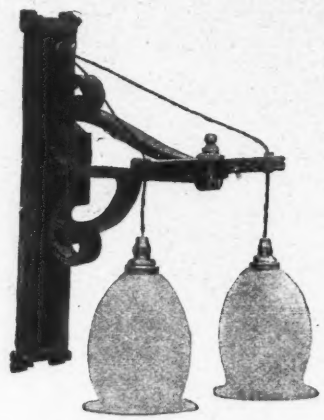


Fig. 2.

rooms are laid out for the convenient inspection by architects, the trade, and their clients.

New Meridian Lamp.

The British Thomson-Houston Co., Ltd., are introducing a new type of lamp, to be known as "the B.T.-H. Meridian No. 4." This lamp has been designed and is manufactured to fill a want created by their B.T.-H. Meridian lamp, where one of smaller size and candle-power than the standard meridian, but larger than the standard 16-c.p. lamp, is required. The lamp can be fixed in the standard bayonet socket lampholder. The special "Prismo" glass

B.T.-H. Meridian Lamp.

shade is very efficient and is accurately fixed to the lampholder by the use of a small shade carrier, or gallery, for attaching the shade to standard fittings, so that the lamp may be burned in any position. We understand that the No. 4 lamp has a rating of 32 to 35 c.p. with an energy consumption of 60 watts. It is supplied with standard bayonet cap, special "Prismo" shade and gallery, and can be fixed in the ordinary fitting without alteration. The lamp is supplied only in 4 in. frosted or obscured spherical bulbs, and for all voltages—100/125 and 200/250.

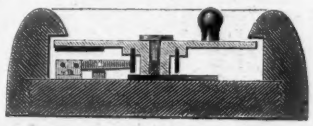
Revolving Switch for Electric Bells.

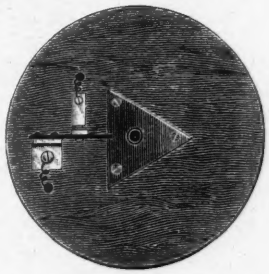
There is shortly to be placed on the market a new paten revolving switch, which has been invented to serve several important purposes connected with bells. In size and appearance it is not unlike an ordinary push, and can be used with advantage in its place. The circular baseboard has a spindle at its centre, on which a circular brass disk, having pins fixed round its centre, revolves when the handle is turned, pressing a spring against a phosphor-bronze contact stop capable of a slight backward movement; thus a succession of contacts is obtained. Terminals for

the line wires are fixed to the two standards. Opposite the handle is an equalising weight, so that whatever position the handle takes up on coming to rest, there will be no pressure on the spring to cause permanent contact. The outside rim screws over the base and also protects the handle and disk from damage.

The following are some of the advantages claimed for this switch: Where trembler bells are considered too irritating, they may be connected for "single-stroke," when a more deliberate hammering is obtained, slowing down like the old-fashioned pull-bell (non-electric), if the push is replaced by a new revolving switch. When used in place of a push on a "trembler" circuit, it gives intermittent "trembler" working, and the ordinary swing indicators can be used with greater effect.

If any number of "single-stroke" bells are connected in series they can be worked continuously. This cannot be done with





SECTION; AND PLAN OF BASE.

"trembler" bells, as the springs cannot be made to make and break circuit together. "Trembler" bells have to be joined in parallel, which necessitates a large battery power.

The ordinary "trembler" bell can be used to give "trembler," intermittent "trembler" and slow hammering, by using two switches in place of two of the pushes, thus giving an indication of the station calling, without an indicator. Alarm bells for schools, ships, factories, &c., work with greater effect and can be of the single-stroke type.

The inventor is Mr. B. H. Thorogood, and the agents are MESSRS. BROMHEAD & CO., of 33, Cannon Street, E.C.

LEGAL.

THE RATING OF ELECTRIC TRAMWAYS.

ON May 15th, in the King's Bench Division, Mr. Justice Ridley and Mr. Justice Darling heard the applications for a rule *nisi* to state a case on the following cases:—The King *v.* Wheatley, Esq., and Others, Justices, &c., and the Liversedge Urban District Council (*ex parte* the Yorkshire, &c., Tramways); The King *v.* Firth, Esq., and Others, Justices, &c., and the Heckmondwike Urban District Council (*ex parte* same), and The King *v.* Same Justices and the Thornhill Urban District Council (*ex parte* the same).

Mr. L. DAVIES said in each of these three cases an order had been made calling upon the Justices to show cause why they should not state cases for the opinion of the Court. No one appeared on the other side, and he asked for the order to be made absolute. The question arose in regard to electric and other light railways in the West Riding of Yorkshire, and the point at issue was whether light railways were entitled to exemption under the Public Health Act, whereby a railway was assessed at a quarter of its full value. His clients, the Yorkshire, &c., Tramways, were the owners of nine railways working the districts of nine different authorities, and they proposed to all the authorities to pay the rate in full, the ultimate liability to depend upon the decision in a case about to be decided by the Courts—viz., the Wakefield Light Railway case. Most of the authorities assented to this proposal, and they paid the rate in full, being given an undertaking for a refund of the three-quarters if the decision in the Wakefield case were favourable to the company. The three local authorities in question would not do this, and they paid the quarter, and ordinary proceedings were taken with regard to the rest. They appeared before the Justices, and they took the point that they were entitled to exemption. The Justices stated that they were wrong, and that they had no jurisdiction to consider such a point on a summons for the enforcement of rates. They declined to state a case. They then applied for a rule which they now asked to be made absolute. The Wakefield case had now been decided, and the Court had held that the company were entitled to the exemption claimed, being regarded as a railway and not a tramway.

The Court then made the rule absolute.

Mr. DAVIES asked the Court for costs, but the Court in its discretion refused to order the Justices to pay the costs.

TRACTION CORPORATION, LTD., *v.* BENNETT.

IN the Chancery Division of the High Court of Justice on Friday, May 18th, before Mr. Justice Buckley, Mr. BUCKMASTER, K.C., in this case said he had a motion on behalf of the plaintiffs for an injunction to restrain the defendant from dealing with, disclosing, or offering for sale an invention relating to a certain system of electric traction until after the hearing of proceedings that were pending before the Comptroller opposing a complete grant to the defendant in respect of the invention. The defendant had filed an affidavit in which he stated that he was willing to give an undertaking in the terms of the notice of motion, the plaintiffs giving the usual undertaking in damages.

COUNSEL for the defendant contended that this motion and action ought never to have been launched. He was, however, prepared to give the undertaking if his Lordship, under the circumstances, thought it proper.

Mr. Justice BUCKLEY: I know nothing about it.

COUNSEL inquired if plaintiffs would give an undertaking in damages.—Mr. BUCKMASTER: Yes.

Mr. Justice Buckley thereupon allowed the motion to stand over on the undertakings mentioned, and made no order except that the costs of the motion be costs in the cause.

FURTHER CLAIMS AGAINST THE L. & Y. RAILWAY.

SEVERAL actions arising out of the disaster at Hall Road, on the Liverpool-Southport electric line, last July—the result of a signalman's error—came before Mr. Justice Bray at Liverpool Assizes last week. In all the cases the L. & Y. Co. admitted negligence on the occasion in question. The case in which Mr. Matear was the plaintiff was settled by consent, the parties agreeing to judgment for plaintiff for £500 and costs in respect of the personal injuries he received in the accident.

Walter Chas. Taylor, merchant and commission agent, of Formby, claimed compensation at the rate of £30 for three weeks' holidays, £35 for medical expenses, and between £500 and £600 for loss of business profits. After hearing the evidence the jury returned a verdict for the plaintiff for £50, the judge deciding that he was not entitled to a penny on his claim for loss of business commission. The award being less than the sum paid into Court by the railway company, formal judgment was given for the defendants.

THE LONDON ELECTROBUS CO., LTD.

MR. JUSTICE BUCKLEY, in the Chancery Division on Friday, May 18th, heard two motions with regard to this company, to rectify the register of the company by removing the names of certain applicant shareholders on the ground that they had been induced to enter into their contracts to take shares on the faith of a misstatement which appeared in the prospectus. There was also a motion in the action to restrain the company from dealing with the money of the applicants paid in respect of shares until after the hearing of the dispute with regard to the rectification of the register.

Mr. BUCKMASTER, K.C., for the applicants, said a letter had been received from the company consenting to an order in favour of the applicants in the terms of the notice of motion, and the company did not think it right to incur expense by bringing counsel. It was also set out that any person requiring the return of his money could be able to obtain it.

His LORDSHIP: That means that they are going to repay everybody?

Mr. BUCKMASTER agreed. He said the prospectus stated 17 advantages of the electric omnibus over the petrol omnibus. The applicants should not complain of this, but of a paragraph stating that the electrically-driven omnibus of the type of which the company had secured a monopoly for a certain time and within a certain district was protected by Letters Patent, whereas what was protected was only an axle or bearing or some part of the machinery. A circular issued by the directors on May 16th, 1906, stated that the improvements referred to in the prospectus "had no reference to the accumulator or motor, but are concerned with the driving and gearing mechanism made use of in the construction of omnibuses of the type which the company proposes to run."

His LORDSHIP thought the statement in the prospectus meant that the company had obtained a monopoly of a particular type of electrically-driven motor.

Mr. BUCKMASTER said that the statements in the prospectus could not be substantiated. He asked for an order for rectification in both cases and the return of the moneys paid, the company to pay the costs of the application.

His LORDSHIP made an order accordingly.

In the other motion in the case of Obru and Others *v.* the same company, an order was taken by consent to the effect that, the company consenting to treat the motion as the trial of the action, the register of shareholders should be rectified, the moneys paid by the plaintiffs in respect of their shares returned to them, and an injunction granted restraining the company from dealing with

the moneys otherwise than by returning the same to the plaintiffs, the company to pay the costs.

Mr. Eve, K.C., moved on the same day before Mr. Justice Swinfen Eady, on behalf of a number of applicants, to have the register of the company rectified by the removal of their names as shareholders, and for the return of the moneys they had paid, with interest. The company had written stating that they consented to an order in the terms of the notice of motion, and that they would not go to the expense of appearing by counsel. The learned counsel said that one of the applicants had made an affidavit, and his Lordship said he could have an order subject to a consent brief. If this was not agreed to, he could have an order for the applicant who had made an affidavit, and the rest of the motion would stand for a week.

On the same day the case of Byrne and Others *v.* the Company was again mentioned to Mr. Justice Joyce by Mr. Hughes, K.C., who asked for an immediate order for rectification of the register by the removal of the names of the applicants. An originating summons, he said, had been taken out by 250 persons under Section 36 of the Companies' Act, and under that summons they asked for relief.

His Lordship made the order asked for, and said the company must pay the costs.

Bradford Tramways Compensation Claim.

It is reported that on Monday, at Leeds, John North, a steeplejack, 43 years of age, sued the Bradford Corporation for £1,000 in respect of injuries received in a tramcar accident last November. Plaintiff was thrown off his seat on the top of a car, his head came in contact with the standard, and his skull was fractured. Within six months his hair had turned perfectly white, and, according to evidence, he had suddenly become an old man. The Corporation offered him £40 as compensation, but the jury awarded £750, with costs.

Chelmsford Electric Lighting Co. *v.* Knights.

Last week at Chelmsford, defendant, a cycle and motor engineer, was summoned by plaintiffs for having, on March 6th, fraudulently prevented an electric meter from duly registering the quantity of electricity supplied. He was fined £2 and 4s. costs.

Breach of By-Laws.

Last week Mr. J. R. Norris, of Manchester Street, Oldham, appeared before the Electricity Committee of the Oldham Corporation to answer a charge of having broken the by-laws of the Corporation by connecting electric wires with the electricity supply without the wires having previously been tested. According to the *Oldham Chronicle*, one of Mr. Norris's men was in the market hall a few weeks ago, when he was asked to couple up the wires in one of the new shops round the market. He did so, although he knew the rules forbade him.

Mr. Norris said he was away when this was done and did not hear of it until the following Monday. He contended that the man should have been called before the Committee, as at the time he was not working for him and had not been paid by him, although he had the contract for the work to be done in the shop. The Committee fined Mr. Norris 10s. and severely reprimanded him.

Damage to an Electrical Installation.

At Berwick last week Catherine Simm was charged with wilful damage to an electric fuse-box. According to the *Northern Echo*, the evidence showed that the defendant, who was leaving a house in which the electric light was fitted, wrenched the box from its holdings with a poker, and bent over the main cable. Her action caused a portion of the Castlegate circuit to be in darkness for some time, while it was also highly dangerous, the full pressure being on the cable at the time. She was fined 24s. 6d. including costs, or 14 days.

Crigglestone Coal Co., Ltd.

In the Companies' Winding-Up Court on Tuesday, Mr. Justice Buckley delivered his reserved judgment on the petition of the British Insulated and Helsby Cables, Ltd., for the winding-up of the Crigglestone Coal Co.

His Lordship said the petitioners were creditors in respect of a debt of £716 for electric cables supplied on December 20th, 1905, under an order given on December 5th. They were unpaid, and they asked for a winding-up order. The debt and the insolvency were both admitted, but the petition was opposed by debenture-holders on the sole ground that there were no assets for unsecured creditors, and that the debenture-holders' security might be affected by a winding-up order, inasmuch as the company's lessors would, in that case, have power to re-enter. The company appeared by counsel who had taken no substantial part in the argument, having, indeed, no interest in the matter. On January 8th, 1906, the directors passed a resolution that the company should cease to carry on business, and a receiver and manager had been appointed. The debenture-holders said—and that he regretted to say was the law—that the owners of a floating charge on all the present and future property of the company were entitled to the goods which the petitioners supplied and were not—as again was the law—liable to pay for them. They said the company's leases contained powers in the lessors to re-enter if a winding-up were made—that a winding-up order, therefore, might injure the debenture-holders, and the unsecured creditors ought, therefore, not to have such an order. Having detailed the history of the company, his Lordship went on to say that he had to consider whether the petitioners were entitled to an order. The law as between a creditor and a company who were debtors was that an unpaid creditor who showed insolvency was entitled to a winding-up order—that was to say, an order by virtue of which a creditor, by the hands of a liquidator, was entitled to seize the assets of his debtor, and administer them for the payment of himself and other creditors. If the order would be useful—not necessarily fruitful—the Court had jurisdiction to make an order. It was no answer as between the petitioner and the company that debenture-holders would or might sweep away all the assets, as between creditors and the company the former were entitled to seize and administer so as, if possible, to escape that result. The parties opposing this petition were for all purposes the petitioners' opponents, and not members of the class he represented. If he made a winding-up order the unsecured creditors would, by the Official Receiver, control the winding up. That was a real advantage to which he thought they were entitled. Beyond this he thought the unsecured creditors were entitled to investigate the circumstances under which this company between November, 1904, and December, 1905, obtained further moneys and issued further debentures to the extent of £40,000, depending for its daily existence upon the willingness of the debenture-holders to find further money. There was no evidence that the lessors would avail themselves of the power of re-entry. The result was, in his judgment, that neither the company who were debtors nor the debenture-holders were entitled to stay the hands of the Court in giving the company's unpaid creditor the statutory remedy—his right to seize and administer by the hand of the liquidator for the benefit of himself and others of his class such assets as he could reach by the operation of a winding-up, and the consequential rights which would flow from it under the Act of 1890. He therefore made a compulsory order.

Mr. Buckmaster, K.C., counsel for the debenture-holders, applied for a stay of the operation of the order pending an appeal.

Mr. Justice Buckley refused the application on the grounds that the company had ceased to carry on business, and that if he refused a stay, the Court of Appeal would see fit to advance it. In his opinion, the Official Receiver ought at once to get into the saddle.

Bulawayo Waterworks Co. *v.* Bulawayo Municipality.

At the Bulawayo High Court, before Mr. Justice Vintcent in March and April, plaintiffs claimed from defendants the difference between 1s. and 1s. 11½d. per unit for 12,665 units supplied to them in October, November and December, 1904. Defendants had paid 1s. per unit without prejudice, but plaintiffs claimed the higher figure under an agreement for "10 per cent. over the cost of generating the current." There were also other points of disagreement as to the hours of lighting, &c. Evidence of Mr. Robert Hammond, of London, and Mr. Arnot, of Port Elizabeth, taken on commission, was read. Evidence was called by defendants to show that repairs, maintenance, rents, rates and taxes, and depreciation were not part of the actual cost of generation. The Judge took time to consider his decision, and delivered his judgment on April 6th to the effect that the term generating the light meant "production of electricity, plus distribution." The term "actual costs of generating light" meant "prime cost of production and cost of distribution." The item "interest on capital account" was disallowed. Only so much of the item "management" as formed part of the salaries of the persons employed in and about the works in the course of actually generating and distributing electricity should be allowed. So much of the items rent, rates and taxes as did not relate to the actual works should be excluded.

The Judge said that so far as he had gone into the matter the price to be paid by the municipality worked out at something less than 1s. Ultimately it was agreed to refer the matter of the figures to an accountant for him to ascertain on the judge's finding what was due. The case is likely to go to appeal to the Supreme Court at Cape Town.

It may be of interest to add that private consumers are charged on a sliding scale from 2s. to 1s. 9d. per unit.

Attorney-General *v.* The Pontypridd U.D.C.

This case came before the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Romer and Cozens-Hardy, on May 17th, on the defendants' appeal from a judgment of Mr. Justice Farwell in the Chancery Division.

The action was brought by the Attorney-General at the relation of the trustees of the Baroness Llanover, deceased, against the defendants to restrain them, their contractors, servants and workmen from erecting or permitting to remain upon any portion of the land at Gwernygerwn, Treforest, near Pontypridd, which was purchased from the trustees in 1902, any building or works not required or intended for the purposes of the defendants' electric lighting undertaking, or from permanently using the land or any part of it for any other purposes than that for which it was acquired—viz., the production and supply of electricity. The relator trustees on their own behalf claimed an injunction to restrain the defendants from using any part of the land or any building upon it in such a manner as to create a nuisance or cause damage to the Llanover estate. It appeared that, after the purchase of the land, the defendants, in

April, 1903, applied to the Local Government Board for permission to use a part of the land for the purpose of a refuse destructor, but were told that the Board had no power to sanction the use of the land for any other purpose than that for which it had been acquired. In the following April the trustees were applied to to accept a re-conveyance of the part of the land on which it was proposed to erect the destructor, and then to convey it back again to the defendants, the latter paying the costs, but this the trustees declined to do. The defendants then went through the form of conveying this part of the land to a Mr. Davis, and taking a re-conveyance from him, the undertaking to re-convey being a condition of the conveyance to Davis, and although informed by the trustees that they objected to the refuse destructor being built there, the defendants commenced the construction of the destructor, although no sanction had been obtained for it from the Local Government Board. The trustees' view was that the destruction of dust and refuse on any portion of the land in question would cause a serious nuisance, and would materially diminish the value of the trust property in the neighbourhood. The nature of the defence was that the scheme of the Council for establishing their works for generating electrical energy included a scheme which was not uncommon in practice for utilising the heat derived from a refuse destructor for working the electric generating machinery. This plan they had, for reasons of economy, adopted in 1901, on the advice of their electrical engineer. Mr. Justice Farwell held that the action of the defendants was *ultra vires*, and granted the injunction with costs. Hence the present appeal of the defendants.

Mr. Danckwerts, K.C., and Mr. R. J. Parker appeared for the appellants; and Mr. Upjohn, K.C., and Mr. Hornall for the respondents.

The hearing was adjourned.

The Marconi International Marine Communication Co., Ltd., and another *v.* Lloyd's.

In the Chancery Division of the High Court of Justice on Tuesday, Mr. Justice Swinfen Eady had before him this action which was brought to determine the true construction of an agreement between the parties as to the working of the plaintiffs' system of wireless telegraphy at certain of defendants' stations.

Mr. Warmington, K.C., and Mr. Gover appeared for the plaintiffs, and Mr. Eve, K.C., and Mr. Ashworth James for the defendants.

Mr. Warmington, in opening the case, said the plaintiffs were the two companies which together controlled the patents and the invention of Mr. Marconi for wireless telegraphy. It was not a case which, so far as he was personally concerned, necessitated any very special knowledge of electricity. The question was really as to the construction of an agreement which was entered into between the plaintiffs and the defendants. The relations between Lloyd's and the plaintiffs commenced in 1901. The course of business at Lloyd's required that they should have early intimation of the arrival of, and also anything that happened to, a ship in the course of a voyage. Lloyd's, prior to 1901, had evidently made considerable inquiries and investigations as to other systems of wireless telegraphy. In the result, those systems were not considered practicable, and, indeed, there were none in actual operation. In 1901 Lloyd's made an agreement with the plaintiffs to adopt the plaintiffs' system. Three or four years afterwards it was said by Lloyd's that the plaintiffs had not fulfilled their obligations under that agreement, while plaintiffs said that Lloyd's had broken certain terms of the agreement. That led to litigation, and the litigation was terminated by an agreement in which there were three clauses which now came up to his Lordship for special consideration. The original agreement, which was dated September 26th, 1901, recited that the Marconi International Marine Communication Co., Ltd., had acquired from Marconi's Wireless Telegraph Co., Ltd., the sole exclusive licence to use for all maritime purposes in all parts of the world, excepting the United States of America, Hawaii, the Republic of Chile, and any colonies or dependencies thereof respectively, certain patent rights and inventions for wireless telegraphy collectively known as the Marconi system and also of other patent rights which Marconi's Wireless Telegraph Co. had or might hereafter acquire or have the power to use. Lloyd's was of opinion that it was desirable that one system of wireless telegraphy should be in general use; the Marconi system had such general use, and had been proved to the satisfaction of Lloyd's to be a good working system. Lloyd's having expended about £4,500 in all in developing certain other systems of wireless telegraphy, it was willing to adopt the Marconi system upon the terms and conditions set forth in the agreement. Under this agreement of 1901 Marconi's system was to be installed at certain of Lloyd's signal stations, Lloyd's to have the benefit of all maritime communications, and the plaintiff companies all sea telegrams received—that was to say, all private messages were to be received for the benefit of the plaintiffs, and all communications with regard to ships and their cargoes for the benefit of the defendants. The system was to be worked by Lloyd's.

Clause 9 of that agreement was in these terms:—

"If at any time during the currency of this agreement the company shall desire to establish a system of sea telegraphy at any of Lloyd's signal stations in any part of the world, and shall give notice in writing to Lloyd's of such desire, it shall have the right to install and maintain such system at such station at its own expense, and Lloyd's shall work such system for the company, and all revenue from sea telegraphy at any such station shall be accounted for by Lloyd's to the company, less only all reasonable out-of-pocket expenses incurred by Lloyd's in complying with the company's requirements. On the termination of this agreement the expense of removing the installation shall be paid by the company. For the purpose of this agreement the expression sea telegraphy shall mean only the receipt and transmission of messages to and from passengers to vessels, messages of public news transmitted to or from vessels and generally any messages transmitted to or from vessels which could not reasonably be described by the expression maritime signalling, as defined in this agreement." On June 7th, 1904, Lloyd's commenced their action against the Marconi International Marine Communication Co., Ltd., but a compromise was come to at the trial: (1) The order staying all further proceedings in the action was dated November 25th, 1905, and the terms of the compromise included the following: "Defendants will concur with Lloyd's in arranging for the British Admiralty if willing to work the wireless telegraphy for the purpose both of maritime signalling and sea telegraphy at all stations in the United Kingdom or abroad, whether defendants' or Lloyd's, at which now or hereafter Marconi's system for maritime purposes is used. This clause not to apply to Poldhu, and similar stations primarily used for shore-to-shore or overland telegraphy. The defendants are to be at liberty to arrange with the British Admiralty the payments to be paid for the expense of working the stations for the purpose of sea telegraphy, and the plaintiffs are to be at liberty to arrange with the British Admiralty, the payments to be made for the expense of working the stations for the purpose of maritime signalling." "(2) At all such stations in the United Kingdom or abroad, and subject to the exceptions stated in the principal agreement of September 26th, 1901, at which the British Admiralty are unwilling to work the wireless telegraphy, and at which sea telegraphy shall for the time being be practised, the working of wireless telegraphy to be under the control of the defendants, or either of them if and so long as they so desire, and if not then to be done by Lloyd's on reasonable notice. In case of any complaint by defendants as to alleged inefficiency of work at any station at which wireless telegraphy is worked by Lloyd's, the sole remedy of the defendants is to be to take over the working of the wireless telegraphy themselves at such station, and not to sue for damages or otherwise. This clause not to include stations on the Suez Canal, in Egypt, or in the Soudan, unless the Egyptian Government consents, but the plaintiffs will use their best endeavours to procure such consent."

"Lloyd's shall not be compelled to work under this clause the telegraphs at any station at which they would not have been bound to work it under the principal agreement.

"As regards stations at which the wireless telegraphy shall not be worked by the Admiralty, the cost of the maritime signalling to be borne by Lloyd's and the cost of the sea telegraphy by the defendants. Any question of apportionment to be settled by arbitration in case of difference, Lloyd's not to pay any portion of the expenses of the Poldhu or any similar station primarily used for shore-to-shore or overland telegraphy.

"Lloyd's and defendants to do their best to persuade the British Government not to grant a licence for use of wireless telegraphy during the continuance of the agreement to any but plaintiffs and defendants.

"Lloyd's to be exclusively entitled to the benefits of all maritime signalling worked by the Marconi system in all countries (except those mentioned in the first paragraph of the principal agreement), the benefits and profits of all sea telegraphy to belong as between the plaintiffs and the defendants to the defendants."

(To be continued.)

His Lordship gave judgment, making a declaration asked for, that, in the events which had happened, the Marconi Companies were entitled to take over the control of the working of the wireless telegraphy at Crookhaven, Malin Head, the Lizard, and several other places, the costs to follow the event. A stay of 14 days was granted to enable the defendants to consider whether they would appeal to the House of Lords.

Tube Patent Appeal.

Lord Justice Romer on Tuesday delivered the judgment of the Court in the appeal of the Simplex Steel Conduit Co., Ltd., from a decision of Mr. Justice Buckley, who, at the instance of the Metallic Seamless Tube Co., Ltd., had granted revocation of Waterhouse's patent No. 28,632 of 1903. The appeal was dismissed with costs. A stay was granted in view of appeal to the House of Lords.

Gas Engine Economy.—In a paper on the "Prime Mover of the Future," printed in an American Exchange, Mr. C. E. Sargent draws particular attention to the reduction of jacket losses. He realises that while the jacket is an unfortunate necessity, its area exposed to the highest temperature gases ought to be a minimum, for since the temperature falls quickly on expansion, the heat will be converted into work rather than into jacket water temperature. Obviously, therefore, high compression, apart from its theoretical advantages, has also the advantage that it produces a minimum of jacket surface in contact with the gases. He next realises how much is lost in the exhaust, and how very late explosion may be when the charge of gas is cut down. In order to cope with this difficulty, he connects the lay shaft with a Rite's governor in such a manner that the shaft is put forward or backward as the load varies, and he shows indicator diagrams to prove that thereby he has succeeded in getting as early an ignition with a poor charge as with a full charge of gas.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Automatic Switches.

Having experienced trouble in trying to obtain certain types of switches, can anyone give me information of a firm or firms who could supply the following, suitable for a three-wire system, 220 and 440 volts?

1. A triple-pole switch, to be actuated from a distance by shunt control to make and break a circuit, carrying a maximum current of 50 amperes each side. Switch to be of such a construction as to be well protected against atmospheric conditions.

2. A single-pole switch to be actuated by an electrically or hand-wound clock directly attached or otherwise, to control a circuit carrying a maximum current of 35 amperes, making contact at a certain pre-arranged time, say, 7.30 p.m., and breaking contact at, say, 11.30 p.m. each night, but missing both actions on Sundays.

J. C. L. V.

Flexible Wire Dangers.

We note with interest Mr. C. Hall's letter under flexible wire dangers in your issue of this week, and we beg to state that in order to prevent such happening with flexible cord, we are making a special flexible with the metallic conductors braided instead of stranded as is usual with flexibles. This braiding renders the conductor much stronger mechanically, is more convenient in wiring, owing to its not fraying, and is very flexible.

Ward & Goldstone.

Manchester, *May 18th*, 1906.

The Separation of Oil from Feed Water.

"J. B.," by his letter in your issue of 27th ult., evidently does not realise what one-third of a grain per gallon really indicates, even supposing that in practice he is always able to obtain this result. Take a plant as an example which deals with 20,000 gallons of condensed steam per hour, then for 24 hours we have the following figures:—

$$\frac{0{\cdot}333 \times 20{,}000 \times 24}{70{,}000} = 2{\cdot}283 \text{ gallons of oil per day.}$$

This means about 16 gallons of oil per week going into the boilers.

Onlooker.

American Postage.

Your note relative to underpaid American postage will, it is hoped, do good. It may be that the English office boy is as great a sinner as the American. If he is, let our American friends say so. Certain it is that very few American letters come here properly stamped. The shortness occurs in several ways. First, and perhaps most usual, is the use of the 2 cent stamp in place of 5 cents; next is the use of one 5 cent stamp on letters of over ½ oz. These two deficiencies involve a cost to the receiver of 6 cents and 10 cents respectively. Then comes the 2 cent stamp in place of 10 cents on a letter for one ½ oz. This gift costs 16 cents to receive. The worst of these things is that very often they are merely trade circulars in closed envelopes that would come for 1 cent if left open. Again, it is quite usual to send quite heavy bundles of printed stuff with only a 2 cent stamp in closed envelopes, and one may pay several shillings for these. The mailing clerks of the United States appear to have no knowledge of foreign postage, but some few firms type the word "foreign" on the envelope so that the typists evidently have instructions to do this. This appears to fix the fault on the creature who does the putting on of stamps. Surely it is time that the charge of double the deficiency was dropped for very much underpaid letters.

Like yourselves, I have been compelled to refuse to receive such letters. It may appear mean if the letter goes back to the sender, but the sender should realise that he is only one of many, and every man whose name appears in the lists of members of any society or institution is inundated with such unpaid stuff. A few months ago I sent word to one correspondent. He apologised, and said the matter should be inquired into. I had to pay threepence for this apology, for it came with the customary two cents stamps.

I would suggest that you print both the English and American rates of postage on various matter for the benefit of all concerned, though even this will not put a stop to what is often the lack of observation of the boy who does the stamping. Finally, is it not time that the postage to and from America was made one penny per ounce, or two cents, so as to put a stop to the annoyance? At present the postage is about sixpence average, and the receiver pays most of it.

Tired of It.

A Celestial Document.

No doubt you come across many curious documents in the course of editing your paper, but I doubt if you often meet a stranger one than the original of the enclosed copy. It is a letter from a consumer, complaining of the light given by an incandescent lamp, and is very typical of the correspondence one gets in this part of the world:—

Canton 31 *March* 06.

Sir
we beg the honour to you that our shop have been use 7 prs of electric lamp, when that has a lamp is not light and spoiled, So that it is have few night. which that pleases send a man to our shop making it for proper and Dont spoiled. Hoping your kind at once to our shop making it of now. and obliged
yours truly
per Kwang Wo & coy
Hing loong strut

The capitals and stops are just as in the original. Hoping that this may be deemed worth printing, I remain one of your distant readers,

Guy H. Thorne.

Canton, *April 22nd*, 1906.

The L.G.B. and Public Lighting by Electricity.

I think the thanks of your readers, and of the electrical profession generally, are due to you for calling attention to the peculiar action of the Local Government Board inspectors in the matter of loans for electric street lighting purposes. The two examples referred to in your last issue, namely, Bridlington and Newcastle, are in themselves proof that street lighting can, in many cases, be carried out more efficiently and economically by means of electricity than gas; but if further proof is needed, it is only necessary to look at the low rates at which dividend-earning electricity supply companies are able to undertake this class of work, and still earn a profit.

In spite of this, one inspector has stated that there is no light so good and so cheap as incandescent gas. The other admits that he is not an electrical engineer, and yet he does not hesitate to criticise the price at which an undertaking can supply and maintain electric arc lamps.

The unfair action of the Local Government Board in this matter would be of little importance if the results were not so far-reaching. One does not complain of the gratuitous advertisement given to the gas undertakings; but of the fact that the Local Government Board are in many cases depriving ratepayers of a possible chance of receiving some *quid pro quo* for the money they have already been allowed to invest in plant, machinery and mains.

The more carefully one investigates the matter, the more inconsistent the action of the Local Government appears to be. For example, the Government, having granted a monopoly of supplying electricity in certain districts with one hand, withdraws the means by which it can be carried out most economically with the other hand. It sanctions loans on the security of the rates for the erection of generating plant, &c., and then refuses to allow the ratepayer to erect lamps on his own premises which could be economically lighted by means of that plant. This is worse than putting a man into prison for debt, and thus making it impossible for him to earn the money to pay that debt; because not only is the ratepayer deprived of the means of

getting any return for his invested capital, but he has also to pay the profits of an opposition undertaking.

Is it surprising that, under the circumstances, municipalities, having the interests of the ratepayers at heart and knowing that the success of their electricity undertakings and the improved lighting of their streets depend on converting the street lamps, are tempted to carry out this conversion first and obtain the sanction of the Board afterwards?

If the gas industry is to be State-aided, I think in common fairness private enterprises should be allowed to compete for the public lighting by other means, and facilities should be granted them for laying the necessary mains; otherwise, progress in this country will be still further retarded.

Haydn T. Harrison.

Westminster, *May 22nd*, 1906.

Neutralised Repulsion Motor.

I will deal with Mr. Fynn's last letter in the order in which it is written.

The first point, that of classification, is for the moment dropped. With regard to commutation, I claim no advantage over any series conduction machine with equal impressed armature E.M.F. I wish it to be distinctly understood that I do not claim to have thought of anything very wonderful or new, but only to have suggested, and experimented a little with, a form of motor which, I think, has its advantages. Not having yet even decided the best proportions for the suggested motor, I am not in a position to discuss the weight efficiency, which is Mr. Fynn's third point. I do not think he is right. But if he is, I will acknowledge it when I have proved it.

With reference to the fourth point, I say that Mr. Fynn is entirely wrong. The torque may be large though the secondary leakage is small, and this is clear from the diagram already published.

Mr. Fynn's fifth point is now most interesting. He proposed a most improbable hypothetical case to prove that the torque was zero. I accepted his case as it stood and disproved his conclusions, whereupon he practically says, "I admit that the torque is not zero, but still I think I was broadly correct when I said that it was"!

Next, Mr. Fynn's contention that the greater part of the flux $o\phi$ in my diagram passes through the air-gap from F F is obviously absurd. For by construction $o\phi$ is clearly defined as "representing the mutual induction between E and B." How is it possible for the flux which is common to these two coils to form part of that which is admittedly a leakage flux?

The general statements made by Mr. Fynn with respect to the diagram figure 1, page 792, are of course obvious. But the conclusions drawn therefrom are most misleading. For there is hardly one of them that would not apply equally to any ordinary polyphase induction motor; indeed, the very diagram referred to (viz., fig. 1), is exactly that used by Mr. Eborall in his Society of Arts lecture (May 17th, 1901), to illustrate the action of polyphase motors.

At the end of his letter, Mr. Fynn says that $\phi\,\phi_1$ is not the phase of the motor field. I say that if *in the particular case which the diagram illustrates* Mr. Fynn can prove his statement, I shall be glad to admit my error.

Apparently Mr. Fynn wishes me now to explain exactly how the motor does operate. I will certainly comply with this request as soon as I can; but as there are three cases to be considered, it can hardly be done in the scope of a letter. May I be excused for saying that if I did not give fuller details before, it was chiefly because I thought that an elementary explanation would hardly be of use to a correspondent, who in his first letter (April 13th) set out to show how faulty the idea was, and how he would carry out such a design.

Will Mr. Fynn be kind enough to wait till I can get this explanation on paper?

William Cramp.

Manchester, *May 22nd*, 1906.

ELECTRICITY AND GAS v. SMOKE.

By C. ALFRED SMITH, B.Sc., A.M.Inst.E.E.

Among the many prophetic utterances of Sir Oliver Lodge, not the least remarkable was that contained in an address delivered at the London Institution a quarter of a century ago. The lecture given recently before the Society of Arts by Mr. A. J. Martin, M.Inst.C.E., reminded me of the stimulating words of Sir Oliver. It is not always that the worker in the laboratory—the man who is probing into the unknown and is occasionally rewarded for his wonderful patience and perseverance by the knowledge that from his test tubes or his induction coils, or his few filings used as the first primitive coherer, there will one day leap forth before a wondering public an "invention," a something which will, perhaps, be a means of indefinitely benefiting the human race—it is not always that the scientific seer lives to hear his forecasts re-echoed by the "practical" man, the applied scientist. Mr. Martin cannot claim any great originality for the general idea upon which his lecture was based, for that was advanced, as I have said, by Sir Oliver a quarter of a century ago. I am afraid that he cannot even claim to have been the first to have worked out data concerning the efficiency of gas transmission, for that was done in 1902 by Prof. F. W. Burstall. In October and December, 1903, the opportunity was afforded me to contribute articles to the Electrical Review upon this very subject, when comparative figures were advanced showing that, under certain circumstances, it is cheaper to transmit energy from the pit's mouth in the form of gas than when converted into the form of electricity. Mr. Kilburn Scott at the time made rather a feeble attack upon these figures, but on being challenged to disprove them he was silent. Nor did he take the opportunity afforded him a few weeks later to criticise similar figures contained in a paper read before the Birmingham Local Section of the Institution of Electrical Engineers in January, 1904. Thanks to the Electrical Review I have a verbatim copy of the report of the discussion on that paper, and although Prof. Threlfall ventured a little good-natured chaff concerning "pious hopes," yet the only real criticism of the scheme for gas transmission was on account of the possibility of leakages. But Mr. Jones, the city electrical engineer for Leamington, said that "he did not see why gas should not be used for the whole of the heating of the city, and why the use of coal should not be absolutely prohibited, thus making the city absolutely smokeless."

When first it was appreciated that electrical energy could be transmitted, great things were expected, and the enthusiasts said that the demand for gas would surely diminish. For lighting purposes, when compared with electricity, gas is dirty and is the wrong agent; for heating and cooking purposes it is, when compared with practically the only competitor, coal, cleanly and labour saving. "Electricity is not going to supersede gas," said Sir Oliver Lodge in 1881, "any more than it is going to supersede coal. What is, I hope and trust, going to be superseded by gas and electricity together is that abominable nuisance smoke." We poor suffering Londoners fail to realise that never in the history of the world was the atmosphere so unbearably polluted as at present. Electricity for lighting and power purposes, and gas for heating and cooking purposes, should be supplied to every establishment, and should be recognised as being as essential to the health of a town as a good water supply and a good drainage system. But let us return to Mr. Martin's recent paper.

Some of his audience may have been alarmed at his forebodings concerning the supply of coal, for he says that "it is practically certain that at no very distant date a cheap and abundant supply of coal, such as we enjoy to-day, will have become a thing of the past." He warns us that prosperity will not thank us for our extravagance, and he makes an appeal from the ethical side. It is unfortunate, but in these matters £ s. d. counts for a great deal more than the thoughts for posterity and ethics. And somehow one is irresistibly reminded of the great clamour that took place some years ago when it was stated that, because we were cutting down the oak trees faster than they

were being planted, England would be one day unable to build her wooden walls, and would, therefore, lose her command of the sea. How disappointed those prophets of evil must have been when they saw that iron ships would inevitably displace the wooden walls of England! And until the price of coal is actually affected by the diminishing supply, such arguments will not affect public opinion. Similarly with regard to the losses in power production, Mr. Martin says that "it is probable that there are large numbers of steam plants at work throughout the country which consume a hundredweight of coal for every pound which would suffice to do the work with a boiler and engine of the most economical type working under the most favourable conditions." It is probably true; but until we can convince the owners that they will save *money* by scrapping their plant and putting in suction gas producers or electric motors, we shall make no progress. So with that pernicious poisoning piece of apparatus, the domestic kitchener. Only 4 per cent. of the heat is utilised, says Mr. Martin, and we know how the limited air of London is polluted by the smoke, sulphurous gases, and every product of destructive distillation. But to get this altered we must show a method which is cheaper. A great deal is quoted from the recent Royal Commission report, to show how 36 millions sterling per annum would be saved with the extended use of gas engines and gas cooking appliances and electric motors, and we are told that "the chief obstacles to the more general adoption of the necessary improvements are due partly to lack of time on the part of the persons concerned to attend to the matter, but in still greater measure to that almost passionate dislike of innovation which is so characteristic of the English and of the Chinese," which latter comparison is, perhaps, the only feeble remark in this interesting paper.

The Comparison of Electrical and Gas Transmission.—We now come to the valuable part of Mr. Martin's work, in which he gives instances from the U.S.A. of gas transmitted for 200 miles at 300 lb. per sq. in. He quotes Prof. Burstall's evidence before the Royal Commission, but he says that the Mond gas does not compare favourably with coal or water gas for transmission, assuming that the cost of manufacture per 1,000 cb. ft. (excluding interest on capital) of Mond gas is 1d., while water gas is 3d. and coal gas is 4·89d. And it is here that the whole crux of the question lies; and it will, I hope, be possible to challenge these figures, for Mond gas can surely be manufactured at less than 1d. per 1,000 cb. ft. But for the time we will accept Mr. Martin's figures.

He makes a good point when he pleads for a reduction in the illuminating power of coal gas. He might have added that those unfortunate people who desire or are compelled to use gas for lighting purposes should be made always to use the incandescent mantle. But the gas companies will benefit most when electricity is supplied at, say, 1d. a unit throughout London, for it will then be used everywhere for lighting, and our friends may well drop the illuminating value of their gas and supply it only for heating and cooking. There would then be a great increase in the demand; indeed, Mr. Martin tells us that "the consumption of gas in London might be increased to four or five times the present amount," although he includes lighting—a small part of the load—in his estimate. Then we come to the figures and estimates, and we find that the cost of compression and transmission of 1,000 cb. ft. of gas are estimated at 0·39d. and 1·04d. per 1,000 cb. ft. respectively. My only comment is that there is no need to go 173 miles from London for the generating station, and that the estimates on the whole are high. A total cost for compression and transmission of 1d. per 1,000 cb. ft. is ample. But the great point is that it costs 8d. per 1,000 cb. ft. to convey coal for gas-making purposes, and so Mr. Martin's generous estimate shows a saving of 82 per cent.

With regard to the high terminal pressure of 250 lb. and the adiabatic expansion "in a suitable engine with a direct-coupled dynamo"—the fact that the gas would emerge at 200° F. below zero and the complications involved in making ice from this render that part of the scheme rather difficult, so we will accept the scheme without this and merely mention it as a possibility. The allowance of 10 per cent. for leakage both for transmission and distribution is again generous, for the London companies only average about 5·5 per cent. loss for distribution. But allowing for 10 per cent. loss and neglecting the ice-making electricity producing scheme alluded to above, we must confess that Mr. Martin has made out a very clear case for selling gas in London at a very good profit for 1s. per 1,000 cb. ft. And how does this affect our electrical generating stations in London? It would mean that the price of electricity would be reduced, for gas at 1s. 6d. would cost less than the coal now consumed by 23 out of the 25 metropolitan electrical undertakings, while the lowest fuel bill (at Hackney) exceeds the equivalent of gas at 1s. per 1,000 cubic feet. Centralisation and concentration in industrial undertakings invariably spell economy. The whole problem of supplying electrical energy to London is now before a Parliamentary Committee. It is to be hoped that the possibilities of gas transmission and gas engines for generating electrical energy will be considered. Some of us have been deeply interested in the fact that Messrs. Mordey & Dawbarn are installing large gas engines at the Johannesburg Electricity Works. They must have good reasons for this plucky decision, and it is to be hoped that they will place these reasons on record. Finally, since the Society of Arts has on more than one occasion taken up the problem of smoke prevention and had some historic trials carried out on the early gas engines, it might also go further with the problem of gas transmission and the production of electrical energy. It may sound very revolutionary and impossible to many engineers; but just as the electrification of the Underground Railway has proved a priceless boon to Londoners, so will the generation of electricity by means of gas engines, and that will be rendered possible by cheap gas. We must be grateful to Mr. Martin for his very interesting paper, and if he has omitted any figures showing the value of electrical transmission he has given figures which should set electrical engineers thinking. We all expect and hope that some day heating and cooking will be done by electricity; but at present it is not practicable in London for that to be universally adopted. We must, therefore, welcome all efforts to produce very cheap gas, which will have the effect of cheapening electrical energy.

BUSINESS NOTES.

Canadian General Electric Co.—It has been recently announced that this company intend largely extending their works at Peterborough, Ontario, shortly, at an estimated cost of from $300,000 to $400,000. The number of workmen at present employed is about 1,000, and these additions will eventually provide work for double that number.

Manufacturing in Italy.—The Tecnomasio Italiano Brown-Boveri, of Milan, which was reorganised in 1903, took over for Italy the patent rights of the Baden firm of Brown, Boveri & Co., which received in payment preference shares amounting to £51,200, or a sum equivalent to the ordinary share capital. It was provided that after the ordinary shares had been paid a dividend of 5 per cent., both classes of shares should be entitled to the balance of profit in equal proportions. The Swiss company now proposes to pay to the Italian company the sum of £51,200, whereby its holding of preference shares will be converted into ordinary shares. By this means the Tecnomasio will reduce its indebtedness, dispose of its department for electrical measuring instruments, and its central stations at Busto Arsizio, Gallarate and Legnano, and obtain funds for extending the plant for the manufacture of machines. The company also proposes to embark on the construction of electric motors for secondary railways.

Holidays.—From the Health Resorts Development Association, of 2, Gray's Inn Road, E.C., we have received copies of booklets which have been published by them for the Town Councils of Weston-super-Mare, Deal, Bournemouth, Woodhall and Southport. They each contain many photographic reproductions of places and objects which are of interest from the holiday-maker's point of view, and useful information concerning the climate, local entertainments, tramway and railway facilities, and other matters is given. The publications have all been edited by Mr. George W. May. We are asked to state that if any of our readers desire to obtain one or other of these booklets, they can be obtained free by dropping a postcard to the town clerk of whichever place they are interested in.

A Hackney Arbitration.—The President of the Institution of Electrical Engineers is to be asked to appoint an arbitrator to deal with matters in dispute between Messrs. Ashton, Frost & Co., the contractors for condensing plant and pipework, and the Borough Council.

B.T.-H. Lightning Arresters. — On Wednesday, May 16th, an extremely severe thunderstorm passed over that portion of Birmingham in which the Birmingham Tame and Rea sewage disposal works are situated, and apparently the high tension line used on this scheme for operating the motors was frequently struck. The line is equipped with B.T.-H. alternating-current lightning arresters, which worked most satisfactorily; we are informed that all the lightning arresters on the line discharged after nearly every flash of lightning, with no resultant damage whatever. The transmission line is a 2,200-volt one, 50-cycle, three-phase, overhead, and is about five miles long. It is not often in this country that phenomena of this kind are met with on so large a scale, and the successful outcome of Nature's official tests is highly satisfactory.

Brush Contracts.—The following contracts have been obtained by the BRUSH ELECTRICAL ENGINEERING CO., LTD.—For the Auckland Electric Tramways Co.—Three radial trucks; two pairs bogie trucks; three complete tramcar motor equipments. For the Bombay Electric Supply and Tramways Co.—Two 500-KW. motor-generators; one 50-KW. ditto; one 50-KW. core type transformer.

Waterworks Telephones.—The ELECTRICAL ENGINEERING AND MAINTENANCE CO. have just completed a further installation of telephones at the Sutton waterworks. Duplicate switchboards have been provided, with change-over switch, so that the various outbuildings and offices can communicate with one another, either in the day or the night.

Catalogues and Lists.—THE BIRMINGHAM ELECTRICAL FITTINGS CO., Broad Street, Birmingham.—A 32-page pocket catalogue of switches and fuseboards. The devices which are described and illustrated, and of which prices are quoted, include the Glasgow porcelain clip-type fuseboard; the firm's new D.P. registered switch mounted on enamelled slate bases separated by an insulated fillet; their block type fuseboard; and their distribution board consisting of D.P. main switch and fuses, and double-pole distributing fuse ways, mounted on slates enamelled both sides and edges, and separated by an insulating fillet. Their type A main knife switches, for which it is claimed that no current passes through the heel piece, and that while being double break both breaks occur simultaneously, are also shown.

THE CONDUIT AND INSULATION CO., LTD., Summers Town, S.W.—New price list (48 pages) giving illustrated particulars and prices of their steel armoured and insulated conduits, solid drawn and welded conduits, together with a complete system of fittings and accessories. Three pages are devoted to a list of some of the more important installations carried out on the company's system. A table is also given showing the wiring capacity of conduits. Prices are conveniently set out in tabulated form.

MESSRS. RICHARDSONS, WESTGARTH & CO., LTD., Hartlepool.—A 16 pp. illustrated pamphlet giving a descriptive account of their convex splash bar cooling towers, their principle, construction and efficiency.

MESSRS. WILLANS & ROBINSON, LTD., Rugby.—New turbine pamphlet (No. C60), containing a description of their Willans-Parsons steam turbine, its system of blading, method of balancing, governing, lubrication, &c. In addition to excellent half-tone views of some of the plants installed by the firm, there are also equally good illustrations and sectional drawings of the blading details and of the turbine itself, showing steam connections to balance pistons. In the pages devoted to the subject of floor space and general arrangement, there is a table of approximate dimensions for machines of from 1,000 to 5,000 KW. There are also a table of speeds, and a list of turbines supplied or on order, as well as views of Siemens, Dick, Kerr and Bruce Peebles electrical machinery designed for coupling to the W. & R. turbines.

MESSRS. ELLIOTT BROS., Lewisham.—Pamphlet No. T.M. 92, describing and illustrating the Partridge's patent sparklet fuses (1906 model), and No. A.C. 75, particularising and pricing their shunted pattern type N N ammeters and wattmeters for laboratory use.

MESSRS. CLARKE, CHAPMAN & CO., LTD., Gateshead.—36-pp. publication giving lists of electric lighting installations and electrically driven ships' auxiliary machinery that they have carried out on warships, merchant vessels, floating docks, steam trawlers, steam yachts and, indeed, almost every kind of vessel afloat. The lists are very imposing, and will at once impress the reader with the very extensive and varied experience of the firm in work of these descriptions. Separate tables give a few particulars of installations that have been packed and shipped for erection in foreign countries. Some half-tone illustrations of the firm's generating plant, windlasses, winches, capstans, &c., are given at the end of the pamphlet.

MESSRS. BOWES, SCOTT & WESTERN, LTD., Broadway Chambers, Westminster, S.W.—Illustrated pamphlet containing details of their patent water-softening apparatus.

MESSRS. T. HARDING CHURTON & CO., Atlas Works, Ingram Street, Leeds.—New list (No. 24) in which is published a description, with illustrations, of their single-phase, A.C. induction motors. A table of prices and particulars is given, the latter including speed, maximum voltage, efficiency, and power factor, for each size of motor from ¾ to 70 B.H.P. A second table shows the B.H.P. and speeds when run on circuits of the various periodicities generally met with.

THE MIRRLEES WATSON CO., LTD., Scotland Street, Glasgow.—New bulletin describing an installation at the Hallside Works of the Steel Co., of Scotland, Ltd., in which the Rateau system of exhaust steam utilisation is employed. The plant installed consists of one 450-KW. turbine generator, and preparations have been made for a duplicate set; the condensing plant is capable of dealing with steam from the two sets (equal to 40,000 lb. of steam per hour).

MR. CHARLES E. MILLER, Reade Street, New York.—Illustrated price list (200 pp.) containing particulars of a great variety of automobile supplies.

MESSRS. VERITYS, LTD.—Three new publications. No. 525 deals with their "Typhoon" desk fan for direct current, which, by means of a patent knuckle joint, can be used for wall, desk or ceiling service. Among the various improvements in detail that have been introduced this year is the making of the blades and guard of brass instead of steel. Circular No. 526 deals with the A.C. "Typhoon" desk fan, which represents quite a progressive step. In circular No. 528 are particularised the "Aston" ventilating fans (from 12 in. to 60 in.), which are already well known; they are made entirely at the Aston works, and are fitted with Aston-Lundell motors. We understand that there is a large demand for these, especially for repeat orders. The trade is reminded that Messrs. Veritys keep large stocks of fans at this time of the year.

MESSRS. E. P. ALLAM & CO., 11, Red Lion Street, Clerkenwell Road, E.C.—The first few belonging to a series of new lists of "Premier" electrical specialities which the company is now issuing. Those before us are conveniently held together in an expanding binding cover, and the later lists can easily be added as they are published. The Premier motor-starters; the new motor-starting switches fitted with slow action gear; high voltage ironclad switches; ironclad house-service fuses and cut-outs; and circuit-breakers, are illustrated, priced, and briefly described in the present sheets. Copies of any of these may be obtained on application to the firm. Later sheets will particularise their fan starters, reversing switches, field regulators, motor panels, lift controllers, distribution boards, &c.

MESSRS. G. STRAUS & CO., LTD., London, E.C.—Circular giving prices of their "British made" flame lamps for direct and alternating current circuits.

THE UNION ELECTRIC CO., LTD., London, E.C.—Illustrated circular (20 pp.) replacing list No. 5,003. It contains a good deal of additional information concerning the "Excello" arc lamps, their construction and erection, treatment, trimming, &c., also the "Excello" carbons. Some space is devoted to new apparatus supplied with the lamps, the "Snowball Excello," and there is also a copy of a report made by the Westminster Electrical Testing Laboratory, with curves of candle-power of enclosed, open and Excello lamps, and a comparative table of running cost economy. A list of places where the "Excello" lamps are in use is also given.

The Telegraphone at Work.—We are informed by the TELEGRAPHONE SYNDICATE, of 28 and 29, St. Swithin's Lane, E.C., that it took a record of Mr. Balfour's speech at the meeting of protest against the Education Bill, held on Wednesday, 16th inst., at the Cannon Street Hotel. Such an experiment in public was made for the first time. A small box containing very sensitive transmitters was located on the chairman's table about 10 ft. from Mr. Balfour, and the telegraphone was standing in a distant corner, connected by wires. The record was very successful. The ex-Premier was much interested, and tested the record of his own speech.

It is interesting to note that the syndicate is using the telegraphone in its ordinary business. Letters are dictated into the instrument, and are repeated by the latter to the typist, who reproduces them directly.

Dissolutions and Liquidations.—The SUN FAN CO., LTD.—A meeting of the principal creditors was to be held at 2, Darley Street, Bradford, the offices of Mr. John Butterfield, the receiver and liquidator, on Wednesday, 23rd inst., to consider the position of the company.

CATANIA ELECTRIC LIGHTING AND TRAMWAYS CO, LTD.—This company is winding-up voluntarily with Mr. A. J. Lawson, 4, Adelphi Terrace, W.C., as liquidator. Creditors must send particulars of their debts to Mr. Lawson, by June 26th.

SIERWALD & ATKINSON, plumbers, electricians, &c., Corporation Road, Middlesbrough.—Messrs. W. Sierwald and H. Atkinson have dissolved partnership. Mr. Sierwald will continue the business in his own name, and will attend to debts.

WALKER & HUTTON, electrical engineers, Scarborough.—Messrs. F. H. Walker, J. Hutton, R. C. Hebden, and E. Thorp, have dissolved partnership, Mr. Walker retiring. The others partners will continue the business as Walker & Hutton, and will attend to debts.

Bankruptcy Proceedings.—T. C. HODGKINSON.—The creditors of Thomas Clement Hodgkinson, 186, Goldhawk Road, Shepherd's Bush, trading as "The Electro-Neurotone," met on Wednesday last week, at the London Bankruptcy Court, before Mr. G. W. Chapman, Official Receiver. The debtor states that he is by profession an electrical engineer, and commenced business in Victoria, Australia. In 1891 he invented an instrument for electro-medical purposes, and patented it in Victoria. A visit was made to England in the following year to bring the invention before the medical profession and the public. A syndicate was formed in 1894 to exploit the patent and sell it to a company, which in 1896 was registered as "The Electro-Neurotone Co., Ltd.," with a capital of £5,000, to acquire the patent for £3,000 in shares. As vendor, the debtor was allotted one-half of the shares, and he was appointed managing director of the company, which went into liquidation six years afterwards. He entered into an agreement on June 24th, 1904, with the liquidators to purchase the assets for £1,500, payable by instalments. The purchase having been concluded, the debtor took over the business, and removed it from Old Bond Street to Shepherd's Bush. The patents had now expired,

and the debtor ascribed his insolvency to having agreed to pay too high a price for them; also to want of capital, and immediately to pressure by creditors. A statement of affairs was submitted, showing liabilities £541, against assets valued at £275. In the absence of any offer, Mr. Percy Coles, chartered accountant (Coles and Stokes), Tower Chambers, Moorgate Street, was appointed as trustee to administer the estate in bankruptcy, assisted by a committee of inspection. The public examination is appointed for June 14th.

T. F. L. RENE, electrical engineer, 64, Catford Hill, lately carrying on business at 9, Plum Tree Court, Farringdon Street, London.—Receiving order made May 19th, on creditor's petition. The first meeting is to be held on June 1st, and the public examination on July 13th, both at Carey Street.

ALBERT DICKINSON, electrical engineer, Leeds.—First meeting, May 28th; public examination, June 26th; both at Leeds.

Trade Announcements.—MESSRS. PULFORD BROS., LTD., of 108, Whitechapel (late 15, Moorfields), Liverpool, announce that, owing to the rapid extension of their business, they have found it necessary to take over the adjoining premises as showrooms for electrical fittings and general supplies. Manufacturers are invited to send their latest price lists and catalogues of fittings, &c.

The EUSTON MOTOR CO., 124, Euston Road, London, N.W., have been appointed British agents for the accumulators of the Société Nouvelle de Accumulateurs B.G.S., of Paris.

The WEST HAM CORPORATION ELECTRICITY DEPARTMENT has removed its head offices to 84, Romford Road, Stratford.

The old-established electrical and mechanical engineering business of MESSRS. GEORGE FINDLAY & CO., at Cape Town, has been taken over by Mr. Walter Hudson, who has been their manager for the last four years. Mr. Hudson has joined the Clyde Engineering Co., and the two businesses will be carried on at the premises of the latter company. Messrs. Findlay intend to continue their engineering supply business, but relinquish all business as contractors.

SIMPLEX CONDUITS, LTD.—The Simplex Steel Conduit Co., Ltd, notifies that its name has now been changed to Simplex Conduits, Ltd., and that the general manager's office is at 11, Queen Victoria Street, E.C.

MESSRS. KRAMOS, LTD., of Bath, have just been awarded a gold medal at the Belgian Electrical Exhibition, which was opened in Antwerp on April 15th, for their electrical drilling machines and pulley blocks. The firm's works have made a speciality of these electric tools; during the last year they manufactured 150 machines, and have at present in hand over 250 drills. They have also lately added to their manufactures their patent electric lifts and hoists, including their push-button lifts.

MESSRS. KRUPKA & JACOBY, as wholesale agents, announce a considerable reduction in price of tantalum lamps. They are now issuing their catalogue, in leaflet form, and will supply copies on application.

Book Notices.—*The Slide Rule.* By C. N. Pickworth, Wh.Sc. Manchester: Emmott & Co. Price 2s.—This work has attained its tenth edition, a fact which speaks for itself. In the new issue the author has introduced some new matter, especially in connection with the new forms of log—log rules and certain special instruments, together with a brief discussion of the theory of the slide rule. Everybody uses this instrument nowadays, and, therefore, Mr. Pickworth's manual is useful to everybody.

Projectierung Elektrischer Licht und Kraftanlagen. By P. Stierstorfer. Potsdam: A. Stein's Verlagsbuchhandlung. Price M. 9.—This book has been written for the practical man, and the author, in the 300 pages at his command, deals in a general way with the design of electric light and power installations. It is divided into three sections. In the first, which takes up about two-fifths of the book, a description is given, more or less in detail, of all the materials, apparatus and machines connected with electric light installations, from mains, switches and fittings to generators, accumulators and meters. The illustrations of these various details are on the whole good, and give a clear idea of modern German practice. To the English student with a knowledge of German, who wishes to extend his acquaintance with German technical words and phrases, this section of the book could be recommended. For example, fig. 43 represents a "Hochspannungsschmelzsicherung"; though a formidable-looking word, he could see at once from the illustration that it means "high-tension fuse." The second section deals with various calculations which must be made before the design of a plant for lighting a house or a small town can be decided on, and some good examples of estimates for house-lighting installations are given in detail. In the third section are found descriptions of some lighting and power plants recently carried out on the Continent by well-known firms; one deals at some length with a light and power plant by Messrs. Lahmeyer & Co. for the town of Kubel, Switzerland, and interesting examples are given of the various tariffs in vogue for the different classes of consumers. An appendix, which takes up 60 pages, and seems to us quite out of place in a book of this sort, contains the rules and regulations of the "Verband deutscher Elektrotechniker." Why these rules should be given in so many text-books we cannot make out. Let us hope the young German student will eventually take them to heart; he will, however, in any case find much which will be useful to him in this book.

"The Journal of the Franklin Institute." Vol. CLXI, No. 5, May, 1906. Philadelphia: The Institute. 50c.

"Bulletin of the Clarkson School of Technology." Vol. III, No. 2, April, 1906. Potsdam, N.Y.: The School.

"American Institute of Architects' Quarterly Bulletin." January, 1906, Vol. VI, No. 4. Washington: The Institute.

"British Engineering Standards Coded Lists," issued by Authority of the Engineering Standards Committee. Vol. III. London: Robert Atkinson (London), Ltd. 25s. net.

"Fire Tests with Floors." No. 109 of the "Red Book" series. London: British Fire Prevention Committee. 2s. 6d.

"Analyse des Métaux par Electrolyse." By A. Hollard and L. Bertiaux. Paris: H. Dunod and E. Pinat. Fr. 6.

"Practical Motor-Car Repairing." By E. W. Walford. Marshall's Practical Manuals, No. 6. London: Percival Marshall and Co. 1s. net.

"Modern Polyphase Machinery." By A. Stewart. London: S. Rentell & Co., Ltd. 5s. net.

"Electric Wiring, Diagrams and Switchboards." By N. Harrison. London: Crosby Lockwood & Son. 5s. net.

"Steam Turbine Engineering." By J. Stevens and H. M. Hobart. London: Whittaker & Co. 21s. net.

New Two-Way Switch with "Off" Position.—We have received from the AUTO-CLAW CO., LTD., of 38 and 39, Beech Street, Barbican, E.C., a sample of a new type of tumbler switch which the company is introducing. In this device the contacts are arranged on either side of the centre, with ample space everywhere between live metal parts, and the contact-making piece is pivoted between them. In the "off" position the contact-piece is held upright by springs; depression of the dolly either way pushes the piece into one set of contacts or the other, according to the direction of motion. The principle of the mechanism is good, and the parts are strongly made; the dolly and cover are insulated from the circuits at all times, and the break is both quick and long. In appearance the switch closely resembles the ordinary types of tumbler switch.

Corner Curve.—This is one of those useful little devices for the assistance of engineering draughtsmen which have become so numerous of recent years. It consists of a celluloid disk with raised edges, with a neat boxwood handle in the centre; in the periphery of the disk are cut 11 curves of varying radii. Instead of using compasses, then, for drawing fillets, &c., the draughtsman selects an appropriate curve and draws it with his ruling pen. This handy instrument is sold by MESSRS. W. J. BROOKS & Co., of Letchworth, Herts.

An Electric Crane Test.—A 10-ton Goliath crane, electrically driven—the first, we believe, to be installed on the G.W. Railway system—has been put in at the railway goods yard at Oxford Road, High Wycombe. It is so built that two distinct rows, of 25 trucks each, can be served at one run, with a great saving in time. A trial trip of the apparatus was made last week in the presence of Mr. Heath, of the firm of Stothert & Pitt, of Bath, who supplied the gantry; Mr. Roger Smith, the principal electrical engineer of the G.W. Railway; Mr. Brandreth, managing engineer of the High Wycombe Electric Light Co.; and others. The gantry is fitted with three Siemens crane type enclosed motors, the motor for the lifting gear being of 20 H.P. capacity; the traversing gear motor is of 5 H.P.; and the travelling gear motor, 10 H.P. The motive power is supplied by means of the overhead "trolley" electrical system from the High Wycombe Co.'s works. We understand that with a load of 10 tons the gantry did the run of 300 ft. well under two minutes, and with an addition of 25 per cent. on the normal load bore the test well; the whole trial was considered to be highly satisfactory.

Tantalum Sun Lamps.—This lamp, which we illustrate complete, is made by MESSRS. SIEMENS BROS. AND CO., LTD., on the same principle as the standard lamp, but is provided with a filament rated for 45 British C.P. and enclosed in a bulb 4 in. in diameter. The lamp proper consists of the bulb, lampholder, gallery and holophane glass shade.

TANTALUM SUN LAMP.

It is claimed that the useful life and the total life of this lamp are appreciably longer than those of the standard tantalum lamp, owing to the larger bulb. The efficiency of the filament is, as with the standard lamp, about 1·7 watts per rated candle-power; but owing to the special disposition of the filament relatively to the holophane shade, it is claimed that a downward illumination is obtained of 180 C.P., giving the remarkable efficiency of ·45 watt per candle-power.

LIGHTING and POWER NOTES.

Aldrington and Hove.—Consumers of electricity in Aldrington are to have the benefit of an alternative flat rate of 5d. per unit.

Barton-on-Irwell.—The Board of Trade has decided to grant an E.L. order, applied for by the R.D.C. in March last, for the districts of Clifton, Flixton, Davyhulme and Barton Moss. Strong opposition was offered by the Flixton P.C. in view of their contemplated application for urban powers. It is the intention of the Barton Council to transfer their powers to the Lancashire Electric Power Co. The first installation will be made at Clifton, where energy is required chiefly for motive power. The powers obtained are not likely to be exercised in the other districts for some time.

Brighton.—It was reported at the meeting of the T.C. on May 17th that it was not intended to take further action with respect to the question of electric wiring by the Corporation.

Broughty Ferry.—The Under-Secretary for Scotland has sanctioned the borrowing by the T.C. of £5,000 for electric lighting purposes.

Canada.—Battleford, Sask.—The T.C. last month decided to instruct the town solicitor to prepare by-laws for the borrowing of $12,000 for an installation to light the town by electricity.

Winnipeg.—A municipal electricity supply scheme is before the C.C. It is proposed to utilise the water-power of the Winnipeg River. It is estimated that by the erection of a dam, about 55 miles from the city, which will give a head of 45 ft., 60,000 H.P. will be available, but for a start the development of 17,000 H.P. is contemplated. The cost of the initial scheme is put at $3,000,000, but by the additional expenditure of $1,000,000 the plant capacity can be doubled.

Cardiff.—Mr. A. Ellis, the borough electrical engineer, reported last week that the net profit for the year ended March 31st last was £1,588, and upon his recommendation the Electricity Committee has decided to carry the amount forward.

Gas has come down in price at Cardiff within the past few weeks, and Mr. Ellis has gone into the question of charges for electricity for lighting and has submitted the following :—(1) To reduce the price on the M.D. system to 7d. and 1½d., and the flat rate to 4½d.; (2) to 6½d. and 1½d. and 4d. flat; (3) the retention of the maximum demand system as at present (7d. and 2d.), and reduce the flat rate from 4½d. to 3½d., equal to a reduced income on the basis of last year's sales of £2,721. He advocated the latter proposal, and it has been adopted by the Committee. A flat rate charge of 1½d. per unit is also to be adopted for power and heating.

Clitheroe.—A London firm has approached the T.C. respecting the sale of the E.L. order, and the town clerk has been instructed to ascertain whether E.L. undertakings in towns of similar size to Clitheroe, have proved a success before any steps are taken in the matter.

Consett.—The Cleveland and Durham County Electric Power Co.'s power station at Templetown has been opened, and energy is being supplied for lighting and pumping at the South Derwent Colliery, Annfield Plain.

Continental Notes.—Finland.—H.M. Consul at Helsingfors reports that the T.C. has finally decided to start its own municipal electrical works, for supplying the whole city with all the electric power required. For this purpose a preliminary loan of £100,000 is to be raised, but this sum by no means represents the total cost of the enterprise. A committee is elaborating the details. Most of the manufactories have their own installations, and some house owners also. The greater part of the electric light and power supply is in the hands of two firms, and the electric tramway company has its own power station.—*Board of Trade Journal.*

Italy.—H.M. Consul at Rome (Mr. C. C. Morgan) states that a scheme has been quite recently submitted to the Municipal Council for utilising the water power existing in the neighbourhood of Subiaco, about 44 miles from Rome, and to build an electric plant for the transmission of energy to the capital. It is contended that the supply could be made at lower rates than the present ones, and the service would be under the direct control of the municipality. —*Board of Trade Journal.*

La Societa per Imprese Elettriche in Roma has secured a concession to put down a water-power plant on the River Tevere, near Rome.

Spain.—A concession has just been granted by the authorities of the province of Toledo for the erection of a plant on the River Tajo at Malpica for generating electrical energy for lighting and power purposes.

Germany.—The municipal authorities of Sonneberg, Thuringia, are about to invite tenders for the electric lighting of the town.

Cotton Mills.—A Lancashire correspondent says that the Fine Cotton Spinners' Association has decided to erect a generating station at Bolton for the supply of power to certain of their large factories.

The Lancs. E.P. Co. is laying mains to Messrs. Nuttall & Sons' Lakefield Mills, Farnworth, to supply additional power.

The new mill at Stoneclough belonging to the Kearsley Spinning Co. is shortly to be started, and electrical energy is to be used for driving purposes.

Devonport.—The accounts of the electricity undertaking for the past year show that the total income was £17,954; the gross profit amounted to £10,310, as compared with £8,685 in 1905. After setting aside financial charges, &c., the balance, £2,623, has been carried to reserve.

Dundee.—Mr. H. Richardson, the city electrical engineer, has submitted an exhaustive report dealing with alternative schemes for the generation and distribution of electric power in Dundee. Four schemes are mentioned providing for new generating stations at Stannergate, at a site near the Panmure shipyard, another near the Esplanade, and extensions to the present station at Dudhope Crescent. He advocates the adoption of a high-tension distribution system, and treats the present power station as a sub-station in the new scheme. It is proposed to distribute at a pressure of 6,000 to 6,600 volts, but if it be decided to extend the present station Mr. Richardson does not recommend the installation of high-tension plant. The new central station plant equipment is to consist of two 1,500-KW. turbo-alternators, with four water-tube boilers. The scheme for the extension of the present station is (1) the installation of two 1,000-KW. turbo-alternators at a cost of £34,330, or (2) one such set at a cost of £19,860. Double the condensing capacity must be provided, two new cooling towers would be erected, circulating and economiser plant remodelled, and forced draught and superheaters might have to be provided for the Lancashire boilers.

The cost of a new station at Stannergate, with distributing stations, is estimated as follows :—

Main station—buildings, plant, &c.	£51,160
Sub-stations.	
Maryfield—buildings, plant, &c.	£3,750
Dudhope—plant, &c.	3,550
West—buildings, plant, &c.	3,750
Lochee—buildings, plant, &c.	5,300
Cables	23,490
Total	£91,000

The total cost of the extension schemes for the Dudhope station would be about £55,930 and £41,460 respectively.

East Barnet Valley.—The B. of T. has made and issued to the North Metropolitan E.P.D. Co. an E.L. prov. order authorising the company to supply energy for public and private purposes within the U.D.

Hanley.—A recommendation of a committee of the whole Council, that the application for the consent of the Fenton U.D.C. to Hanley obtaining a prov. order to enable it to supply electricity within the district, has been withdrawn. A long discussion took place upon the minutes of the E.L. Committee, who recommended that the surplus of £1,266 accruing from last year's working, be allocated to the depreciation and contingency fund. Ultimately it was resolved to allocate half to the rates and half to the contingency fund.

Hendon.—Steps are about to be taken to lay cables for the supply of electricity in central Hendon. The D.C. has transferred its E.L. order to Messrs. Crompton & Co.

India.—Cauvery Power Scheme.—*Indian Engineering* states "the mishaps which first led us to misdoubt, at its first inception, the success of the Cauvery electrical supply have at length befallen it, and the water supply has run so short that Kolar has had to resort to supplementary steam power. It is . . . . probable that local drought will intensify for some weeks the present considerable shortage. . . . Major de Lotbiniere, before leaving Mysore, had fully contemplated . . . creating one or more storage reservoirs. . . . . We hope that a site can be found where the depth of water impounded will be considerable. Shallow tanks, however cheap in first cost, are regular wasters in Southern India by dint of loss due to evaporation."

Kidderminster.—The T.C. on May 16th decided to consent to the application of the Stourport and Kidderminster E.L. Co. for a prov. order authorising the use of the existing generating station in the borough for supplying energy outside the town.

Liverpool.—The C.C. has adopted the recommendation of its Committee to let out motors on the hire-purchase system, for a period not exceeding five years.

From June 30th the charges for energy for lighting will be reduced as follows :—Up to 3,000 units per quarter, 3½d. per unit; over 3,000 and up to 10,000, 3d.; beyond, 2½d. For power or heating the charges are, up to 3,000 units per quarter, 2d. per unit; over 3,000 and up to 10,000, 1½d.; beyond, 1d.

London.—St. Pancras.—The new head offices of the Hearts of Oak Benefit Society are lighted electrically, energy being supplied from the mains of the St. Pancras B.C. There are some 1,000 incandescent lamps, about 270 of which are carried by specially designed bronze electroliers, made by Messrs. Veritys, Ltd. The lighting of the clerks' desks and tables has also received special attention. The contractors for the electric lighting are Messrs. Donnison, Sillem & Co. There are five electric lifts, namely, two passenger, two book, and one service lift. All have been made by Messrs. R. Waygood & Co., Ltd. The contracts for the electric lighting and for the electric lifts were

executed in accordance with plans and specifications prepared by Mr. W. H. Thornbery, consulting engineer, Birmingham, and under his supervision.

SOUTHWARK.—Nine additional "Excello" arc lamps, at a total cost of £102 16s., are to be put up between the Library and the Elephant and Castle as an experiment.

MARYLEBONE.—After the rewiring in connection with the change of pressure of 11 of the flats and two staircases of Bickenhall Mansions, the Phœnix Fire Office refused to endorse the policy unless the work was done over again in steel tubing. The cost of this would amount to £34 for each flat. The owners of the mansions offered to pay one-third of the cost, and the whole cost of redecorating if the Council performed the work. An agreement is to be entered into upon the foregoing lines.

Luton.—Out of the profit of £1,200 on the E.L. undertaking, the T.C. has voted half to the relief of the rates and the balance to a reserve fund.

A loan of £7,000 for E.L. extensions has been applied for.

Manchester.—An inquiry on behalf of the L.G.B. took place last week, with reference to an application by the Corporation for power to borrow a further sum of £63,000 for the purposes of the electricity undertaking. The amount was made up as follows:—For plant at nine sub-stations, £8,656; for supply of energy to six firms, £14,000; for prospective requirements in the supply of motive power, £12,450; and for distributing mains, service mains and other equipment, £27,394. It was explained on behalf of the Electricity Department that the new loan would not necessarily involve any charge upon the rates; on the contrary, it was hoped that in a few years the department would be in a position to relieve them. It was calculated that six large firms who proposed to take energy for power purposes, would use at least 10,000,000 units per annum, and a would-be customer was the Fine Cotton Spinners' Combine.

Mr. S. L. Pearce, the chief electrical engineer, said the borrowing powers asked for were in respect of (1) additional converting plant at nine sub-stations; (2) the provision of transforming plant and switchgear for the three-phase sub-stations supplying electrical energy for a portion of the power requirements at the works of Messrs. R. Johnson & Nephew and the Shaw-Jardine Cotton Mill. A sum of £10,100 has been further provided in the estimate for prospective consumers of this class requiring large three-phase supplies. Agreements have recently been entered into with Messrs. Armstrong, Whitworth & Co. for a supply of energy to their large works at Openshaw, Messrs. Beyer, Peacock & Co., Mr. Hans Renold, engineer, and Messrs. Mather & Platt, Ltd., which will entail an expenditure under this heading of approximately £5,000; (3) the provision of two new lighting feeders for the supply to the northern portion of the city area; the provision of distributing mains in various parts of the city and in the district of Levenshulme, and to the works of Messrs. Johnson & Nephew, and Messrs. Shaw-Jardine's mill, and the provision of further service mains; (4) the provision of two new traction feeders in the city, and one in Levenshulme; (5) £12,000 for additional mains to supply prospective consumers; and (6) an expenditure of £500 for instruments and testing apparatus for the laboratory.

Since the establishment of the department in 1903 a sum of £300,768 had been set apart as a sinking fund for the liquidation of borrowed capital, a sum of £108,515 stood to the credit of reserve and renewals suspense accounts, and a sum of £52,964 had been passed over to the city fund. The total of these sums, namely £462,247, represented the aggregate profit which the Corporation had made from its electricity undertaking from the commencement of supply up to the present date. Mr. Howarth asked that the loan might be for a period of 25 years. Replying to a question, he said he did not think it was the first duty of a trading department to aid the rates, their primary concern should be to maintain a sound financial position. It would not be financially sound without a substantial reserve. The subsidising of the rates was a secondary matter.

The Manchester and Salford Property Owners' Association were represented at the inquiry, and put some questions to the witnesses with a view to show that the electricity undertaking was over-capitalised; but no evidence was adduced to substantiate their criticism.

The Inspector (Mr. H. R. Hooper) will report to the Local Government Board.

Mansfield.—It has been decided by the T.C. to apply for a loan of £8,000 for electrical purposes.

Musselburgh.—The local E.L. and Tramway Co. has decided to reduce the price of energy for lighting from 5d. to 4d. per unit.

Radcliffe.—The U.D.C. has reduced the price of energy for power as under, the charges being net:—Up to 60 units per H.P. per quarter, 2d. per unit; over 60 and under 100, 1½d.; over 100 and under 200 1½d.; over 200 and under 250, 1¼d.; over 250, 1d. This refers to the supply between 6 a.m. and 6 p.m.

Rothesay.—The Town Council is to take expert advice on the E.L. installation, which is not apparently giving satisfaction.

Rugby.—The U.D.C. has reduced the price of energy for lighting to large consumers as under:—First 500 units per quarter, 5d. per unit; second 500, 4½d.; beyond, 4d., with a discount of 5 per cent.

Shrewsbury.—A new 350-KW. set was started up by the Chairman of the Lighting Committee a few days ago.

South America.—The *Board of Trade Journal* quotes the *Brazilian Review* as stating that in addition to the electrification of the Bahia tramways, hydro-electric works on the River Paraguassu are being initiated with a view to utilising the Falls of Tymbora, distant from the city of Bahia about 120 kilometres. The power is estimated at 30,000 KW.

Stafford.—The annual report of the Electricity Department shows that the total revenue from all sources was £4,134, as compared with £3,537 last year, and the expenditure £1,583, as against £1,410 in 1905. From the gross profit of £2,551, £903 is set aside to interest charges, £1,083 to sinking fund, and for depreciation on mains and battery it has been decided to allocate £1,400. The Committee asked for a contribution from the rates equal to the amount of loans repaid for the year, viz., £1,082. The department has earned a net profit on the year's working of £486. The report was adopted, and the Council decided, on the recommendation of the Gas and Electricity Committee, to purchase a 150-KW. set from Messrs. Willans & Robinson for £725. Alderman Wright stated that the set, which was practically new, had been obtained through negotiation with a Lancashire firm who were reconstructing their works.

Swinton and Pendlebury.—A new agreement with the Lancashire Electric Power Co. for the supply of energy in bulk has been prepared by the U.D.C.

Tynemouth.—Although lacking official confirmation, our Tyneside correspondent writes that there is little doubt that an important agreement has been made between the Corporation and the Newcastle-upon-Tyne Electric Supply Co. respecting the supply of electricity in the borough. The general effect of the agreement is one of mutual co-operation in providing a supply of electrical energy, and the Corporation has agreed to take a supply of electricity in bulk from the company. The Corporation works have been in operation about five years, and the capital expenditure has been £88,891. They have not been a financial success, for the accumulated debit in 1904 amounted to £3,386. There was a very slight profit in the following year. It is stated that the company will supply H.T. three-phase energy, which will be converted at the Corporation's station into D.C.

United States.—ELECTRICAL COMBINE.—Every light, power and traction company in the Lower Willamette Valley, including Portland, Oregon, using electrical energy, was consolidated on 3rd inst., the deal involving a consideration of $30,000,000. The purchasers are Messrs. E. W. Clark & Co., E. & W. Seligman and Co., and Pratt & Co., of New York. The principal companies absorbed, and the estimated value of each are as follows:—Portland General Electric Co., $10,000,000; Portland Railway Co., $12,000,000; Oregon Water, Power and Railway Co., $5,000,000; City Light and Traction Co., of Salem, Oregon, $500,000; Vancouver Light and Power Co., of Vancouver, Wash., $200,000; and the Union Light and Power Co., of Silverton, Woodburn and Mount Angel, Oregon, $100,000.

Walthamstow.—Sanction has been received from the L.G.B. for the borrowing of £15,382 for the purchase of plant.

The proposal of the U.D.C. to extend the E.L. to the Higham's Park, at a cost of £10,000, is meeting with much opposition from ratepayers.

Wednesbury.—In the annual report of the finances of the Corporation, it is stated that the electric lighting department has lost £202 on the year's trading. In the near future, provision is to be made for depreciation; so far no amount has been set aside for this purpose.

West Ham.—At the meeting of the Corporation on Tuesday, the electrical engineer (Mr. A. H. Seabrook) reported that Mr. Trotter, electrical advisor to the B. of T., recently paid an unofficial visit to the power station, and expressed himself perfectly satisfied with the manner in which the overhead arc lighting wires had been erected by the Tramways Department. Mr. Trotter stated that West Ham had established a precedent in this matter, and he had had many applications from other towns for sanction to use the same system, and, therefore, came down to see for himself the appearance and safety of the overhead wires. The report was adopted.

The increased revenue of the B.C. electricity undertaking for 1905-6, over the year 1904-5 was £8,019, made up as follows:—Private lighting, £367; power, £1,509; traction, £5,260; public lighting, £882. The electrical engineer reported that the agreement with the Dock Co., as regards the supply to Silvertown, was now practically settled. To provide for all future requirements, it would be necessary to lay eight conduits from Hack Road to Custom House station, six from there to Silvertown station, and four from there to Odam's Wharf. The total cost is estimated at £17,239, which would include the following items:—Two 6,600-volt cables, £6,741; transformers, switchgear, and connections, £6,835. The plant proposed will be capable of transmitting a minimum of 8,000 KW. Without any canvassing, inquiries have already been received for some 2,000 H.P., and immediately the agreement is settled, vigorous canvassing is to be commenced. One inquiry is from a large flour-mill, and a supply of over 5,000,000 units per annum will be required if it is induced to install electric driving. Tenders for the cable, transformers, &c., are to be considered as soon as possible in order that the work may be put in hand. The report has been approved by the Corporation, and the electrical engineer authorised to proceed

with the work as soon as the agreement with the Dock Co. is executed.

Willington.—Having got all it asked for, the U.D.C. has withdrawn its objection to the application of the Mid-Durham E.L. Co. for a prov. order for E.L. The use of overhead wires has been prohibited, and the undertakers will have no power to sell the undertaking to another company.

West Bromwich.—Owing to a leak on Wednesday last week several persons were surprised by experiencing slight shocks on the footpath in the High Street. A report states that the capering of pedestrians as they walked across a manhole cover afforded considerable amusement to onlookers.

York.—At the adjourned quarterly meeting of the C.C. held on Monday last, Mr. Alderman Purnell was to give notice of his intention to move the following resolution, *re* the electricity works:—

1. That Messrs. Willans & Robinson's report and explanation as to the recent breakdown of No. 8 engine be presented to the Council.
2. That Mr. Hame's report on the breakdown, and the analysis of the water be obtained, be presented to the Council.
3. That Mr. Midgley, having been in our employ and in charge at the time of the recent breakdown of No. 8 engine, be asked to give a full report thereon.
4. That this Council, in view of the electric light installation having been now six years in operation, instructs the Electricity Committee to obtain an expert valuation of all their assets in detail.—*York Herald.*

TRAMWAY and RAILWAY NOTES.

Bolton.—The Corporation Tramways Committee has transferred £4,058 from the tramway profits for the past year to the relief of the rates. The profits show an increase of £3,117 on the previous year's results.

Canada.—Escaping electric currents are said to be responsible for considerable damage to the water mains of the city of Winnipeg, and so serious has the electrolysis question become, that a writ has been issued by the civic authorities against the tramway company for $100 alleged damage done to one of the city's water mains. It is thought that this may be the beginning of a long series of litigation.

Chatham.—Work was commenced on Monday at Chatham with the extension of the Chatham and District Light Railways Co.'s system from Chatham Hill to Rainham, a distance of 3½ miles. The contractors are the British Thomson-Houston Co., Ltd., Mr. W. Boddy (chief engineer) superintending operations. The new line will be a single track with loops, and is to be worked on the overhead system.

Continental Notes.—SWITZERLAND.—A concession has been granted for a cable railway driven by electricity on the Burgenberg. The railway will be single track with 1 metre gauge, and is estimated to cost 425,000 fr. A concession has been granted for the construction and exploitation of an electric railway (partly tramway) from Lugano (piazza Giardino) *viâ* Cadro to Dino, and a company is to be formed in Lugano to take up the concession. The length of line proposed is 9,750 metres, and the estimated cost, 900,000 fr. Powers for the construction of a railway from Carouge to the frontier, near Croix-de-Rozon, have been granted to Messrs. Cramer-Micheli, Mabut and Fouilloux, of Geneva, who propose to form a company for the work. The railway will be metre gauge, and may be either electric or steam. The estimated cost, if electric, is 360,000 fr., and if steam 230,000 fr. A concession for a tramway from Uster to Pfaffikon has been granted to Messrs. Rudolf Furst and Guido Meyer, of Oerlikon. The tramway will be electric, single-track, metre gauge, and is estimated to cost 406,447 fr. The A.G. Langenthal-Jura-Bahn, of Langenthal, has received a concession for a light electric railway from Langenthal to Oensingen. The gauge will be 1 metre, estimated cost 1,240,000 fr. A concession has been granted for an electric single-track tramway from Schwamendingen *viâ* Maur to Messikon, at an estimated cost of 500,000 fr.; and a concession has been granted for a single-track electric railway from Zweisimmen to Lenk, at an estimated cost of 995,000 fr.

TYROL.—The A.G. "Stubaitalbahn" proposes to construct an electric cable railway from Fulpmes to the Alpe Frohneben, according to the project of Engineer Riehl. The line will be metre gauge, and the estimated cost is 250,000 kronen.

ITALY.—The steam tramways from Florence to Ligna and Chianti are to be converted into electric lines.

Dumbarton.—The Commissioners under the Private Bill Procedure (Scotland) Act, on Wednesday considered the Order promoted by the British Electrical Supply Co. to construct tramways extending from Clydebank to Balloch *viâ* Dumbarton. The Commissioners decided not to give the promoters power to supply electricity to local authorities, but this decision was not to prejudice any application to the Board of Trade by the promoters for the supply of electric light under an electric supply order. The preamble of the Bill was passed.

The Commissioners threw out a clause in an order promoted by the Glasgow and South-Western Railway Co. asking power to run motor-omnibuses as feeders for their railway. The clause was objected to by the Glasgow Corporation Tramways and the Port Glasgow and Greenock Tramways Co.

East Ham.—At the meeting of the Town Council on Tuesday, a letter from the North Metropolitan Tramways Co., relative to the opening of negotiations for the purchase of its undertaking in the Romford Road, was referred for consideration to the Council in Committee. The borough engineer was directed to prepare and submit plans and estimates for the connecting of the Plashet Lane terminus to the West Ham tramway lines in Green Street.

Exeter.—The first year's working of the Exeter Corporation tramways, an overhead trolley system installed at a capital expenditure to date of £72,927, has resulted in a gross revenue of £14,449, or 13·766d. per car-mile. The total working expenses were £8,049, or 7·648d. per car-mile; traffic expenses were 2·889d.; general expenses, 1·578d.; repairs and maintenance, 0·602d.; energy, 2·579d. per car-mile. There is carried to net revenue account £6,400, of which £2,619 goes in interest on loans, and £3,508 is available for the appropriation account. Of this, sinking fund charges absorb £1,488; £1,000 is placed to a reserve and renewals fund; £520 is carried forward to the revenue account for the current year, and the remaining £500 is handed over in relief of the city rates, being equal to ⅜d. in the £. The City Council has accepted contracts for the immediate construction of an extension ¾ mile in length. The tramways last year paid 1¾d. for the first 100,000 units of energy, and 1⅜d. for the remaining 265,096 units used; and the Committee is asking the Corporation electricity undertaking for better terms.

Glasgow.—The cars are being fitted with a small detachable mirror at the driver's platform, by which the driver can see inside the car as well as the rear platform without turning round.

The Tramways Committee of the T.C. sent a deputation to London last week and interviewed the assistant secretary of the Railway Department of the B. of T. in regard to the order requiring the fixing of rear red lights on the cars. It was explained to the deputation that it was necessary to have a universal by-law throughout the country, applicable to all vehicles. The Corporation is now experimenting with rear red lights.

Hastings.—The T.C. has come to terms with the tramway company with regard to the tramways along the Front, which are to be constructed on the Dolter surface-contact system.

Herts.—The C.C. has applied to the Light Railway Commissioners for an order enabling it to construct light railways from Watford to Bushey and Barnet.

Ipswich.—The report of Mr. Frank Ayton, the manager, on the second year's working of the electric tramways shows that the total revenue was £21,426 (£1,963 less than last year), and the working expenses £16,254, a reduction of £2,614. Interest on capital absorbed £4,215, and sinking fund £1,313; the net loss on the year being £710. The percentage of working expenses to receipts was 75·86; the revenue per car-mile was 7·867d., and the expenses 5·968d. The journeys per head of population were 75, and the total car-miles run 653,617. The energy consumed per car-mile was 1·114 units.

Liverpool.—The City Council has accepted on the recommendation of the Tramways Committee to abandon 1½d. fares. The experiment, which has been tried for six months, has resulted in a loss of £1,153.

London.—L.C.C.—On Tuesday it was stated in connection with the forthcoming reconstruction of the tramways between the Angel, Islington, and Highbury that the Highways Committee had arranged for the laying of the cable ducts to be executed by Reid Bros., as an extension of the existing contract, at an estimated cost of about £1,400. The necessary switchgear and feeder-pillar will be obtained from Eckstein, Heap & Co. and W. T. Glover & Co. respectively at the schedule rates under their present contracts, at estimated costs of £175 and £35.

The Highways Committee presented a report in reference to the scheme for the construction of tramways along Edgware Road, which was recently struck out of the Council's Tramways Bill by the Select Committee of the House of Commons. In the opinion of the Highways Committee the proposed tramways along Edgware Road between the Marble Arch and Cricklewood would be of great benefit to the districts sought to be served, and it asked for authority to confer with the Middlesex County Council with reference to a further application to Parliament for powers to construct the lines in question.

To-morrow Mr. Evan Spicer, chairman of the L.C.C., will open the new Vauxhall Bridge, and afterwards the first portion of the Greenwich generating station, which is now complete.

Luton.—At the invitation of the G.B. Surface Contact Co., the T.C. has resolved to send a deputation to inspect the tramway system at Lincoln. A report as to the advisability of adopting the system at Luton will be prepared.

United States.—According to a correspondent of the *Daily Mail*, 1,200 ft. of the Brooklyn "Tube" Tunnel, now being completed under the East River, has been flattened by the weight of sand and water above to such an extent that the trains will have no room to pass. The depression varies from 6 in. to 2 ft. The tunnel was begun in September, 1903, and ought to be completed next September at a cost of £2,200,000, whereof the city contributes £400,000. A consulting expert declares that the damage will involve a delay of three years, but the constructing engineer and contractor maintain that it can safely be patched up by the end of the year.

(Continued on page 847.)

Boiler Explosions in United States.—According to a report by the Fidelity and Casualty Co., of New York, the company made 144,271 inspections last year, of which 34,046 were internal examination of boiler, and 80,072 were external, and 30,153 inspections of lifts were made. From January 9th to March 5th the company report 27 boilers ruptured or exploded; whether any or all of these were their own clients' boilers, does not appear in our information, but it appears a fair crop during less than two months, and does not speak particularly well for the system of licensing boiler attendants, which we believe prevails more or less throughout the United States. Over 15,000 defects were reported during the year, such as furnaces out of shape, safety valves overloaded, defective pressure gauges, excessive scale, and so forth. The large extent of the United States, the comparatively few boilers per square mile, and the roughness of the surroundings of many of them, together with the general greater crudity of boiler making, combine to render the lives of men engaged in boiler insurance anything but a picnic. We have previously referred to the stupid practice of New York policemen—in New York the police run a sort of boiler inspection department—who drive up to a boiler in a wagon, put a heavy hydraulic pressure inside it, and having carefully over-strained the boiler, leave it "certified as safe," to burst at a moiety of the hydraulic pressure to which it has thus brutally been subjected.

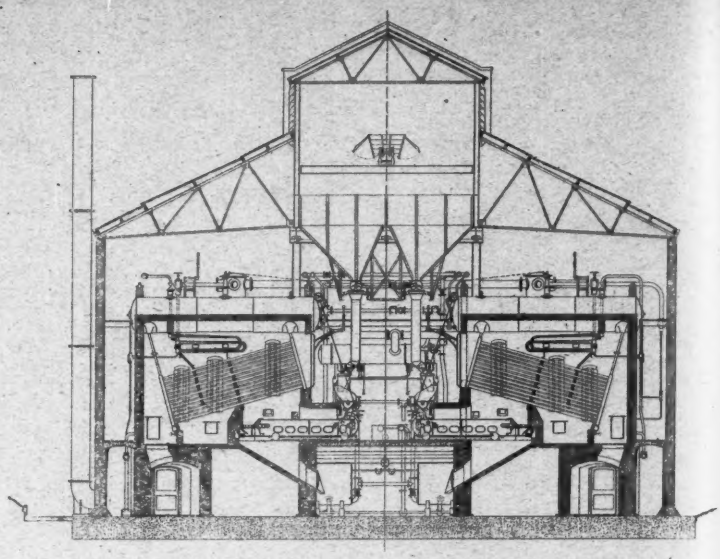


Fig. 1.—Cross-Section through Boiler House; L.E.P. Co.'s Station

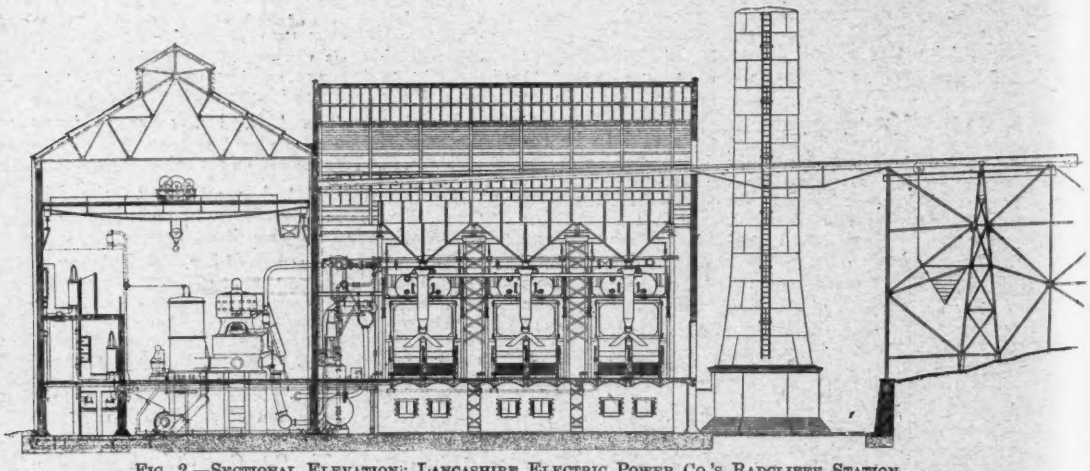


Fig. 2.—Sectional Elevation; Lancashire Electric Power Co.'s Radcliffe Station.

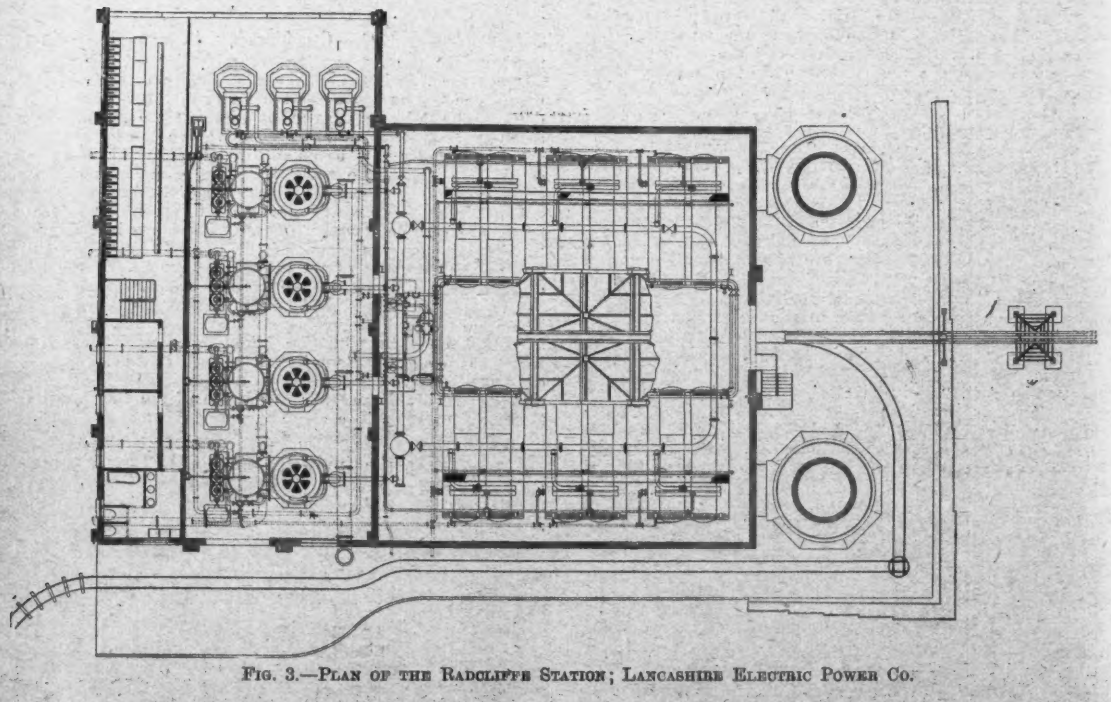


Fig. 3.—Plan of the Radcliffe Station; Lancashire Electric Power Co.

Belgium.—The balance-sheet of the Antwerp Telephone and Electrical Works Co., of Antwerp, for the last financial year shows a loss of 89,842 fr. (£3,592).

THE LANCASHIRE ELECTRIC POWER SCHEME.

The official opening of this scheme by the Earl of Derby, which took place in October last, opened up to one of our most important industrial areas the unquestioned economic advantages of cheap electric power.

The municipal areas of Liverpool and Bootle, Manchester and Salford, also of Bolton, are excluded from the company's operations, as is the case with certain boroughs in the Yorkshire area, and although the general powers of the two

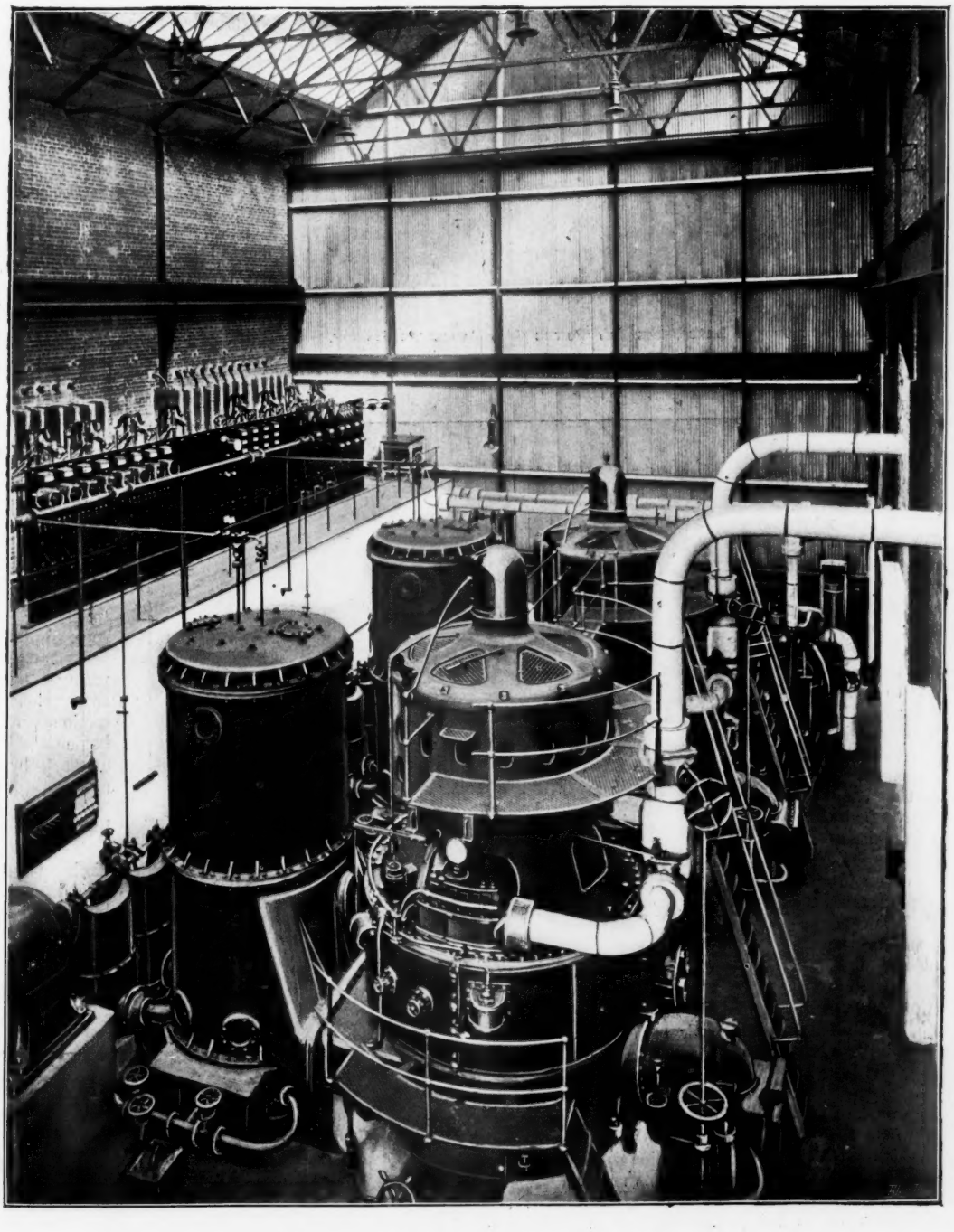


Fig. 4.—General View of the Generating Plant, showing the Operating Switchgear with the Outgoing Feeders Behind.

The area of the Lancashire company, although not so extensive as its sister scheme in Yorkshire, yet embraces 1,200 sq. miles of country lying between the River Ribble in the north and the River Mersey in the south, and containing approximately 18,500 factories, together with some 700 quarries, blast furnaces, collieries, &c.

companies are much the same, yet the Lancashire scheme labours under more onerous special restrictive clauses.

Furthermore, as our readers are well aware, the Lancashire spinning mills with their highly efficient power plant, which constitute the most important section of power-using concerns in the county, do not readily lend themselves to

economical conversion, although both Continental and American experience have recorded substantial improvements in output and product where electrical driving has been adopted.

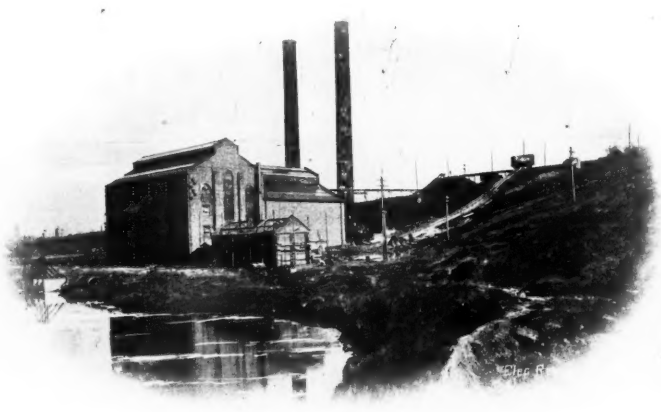


Fig. .—Exterior of the Lancashire E.L Power Co.'s Radcliffe Station.

In the case of such existing concerns, therefore, the company is faced not only with the problem of supplying at the lowest possible price, but also of proving to the owners accompanying advantages sufficient to compensate for the expense of reorganising their driving arrangements.

That the company will eventually succeed in this, as in other directions which offer it an easy preference, we firmly believe.

Fig. 6.—A View in the Boiler House.

The site for the company's first power station is situated on the outskirts of Radcliffe. The station, shown in fig. 5, is built on the left bank of the River Irwell, and is contiguous on the other side to the Lancashire and Yorkshire Railway and the Outwood pit of Messrs. Thos. Fletcher & Co., Ltd. Such a locality obviously favours an economical supply of both fuel and water.

As a whole, the station and plant do not differ to any material extent from the Thornhill station of the Yorkshire Electric Power Co. (described in Electrical Review, September 1st, 1905), both stations being built from the designs of Mr. H. F. Parshall, consulting engineer, who was associated, in the case of the Lancashire scheme, with Messrs. Lacey, Sillar & Leigh. As at Thornhill, the station is laid out on the unit principle, the present building being designed to contain two complete units, each comprising a battery of three boilers with one chimney, and auxiliary plant, supplying steam to two turbine units, which in turn feed one section of the H.T. bus-bars. Unit extensions will follow in due course, with the difference that a single large turbine will take the place of the two smaller sized machines installed in the first instance.

The divergent features of this station, as compared with the Thornhill installation, are in the coal-handling plant, which dispenses with a power-driven conveyor in favour of an ingenious gravity operated arrangement; and in a slight modification in the engine house design and position of the auxiliary plant.

Coal is obtained from the adjacent pit, in trucks, which are shunted on to a siding constructed by the company, which lies parallel to the L. and Y. Railway, and some 50 ft. above the site of the power station.

Here an electric locomotive fitted with a 10-ton crane jib and with a trolley for travelling purposes is utilised for tipping and shunting. The crane was supplied by Messrs. Stothert & Pitt, and the electrical equipment by the B.T.-H. Co. The overhead network for its operation is energised from the auxiliary circuit of the power station.

The trucks of coal, after being shunted, are tipped into a hopper constructed under a portion of the siding; from the hopper, one-ton lots of coal, are measured into a small truck which traverses a narrow gauge tramway supported on trestle work and having a falling gradient of 1 in 33 into the boiler house, where it terminates over the coal bunkers.

The momentum of the loaded truck is partly absorbed by means of a balance weight suspended under the trestle by a wire rope, so placed that the truck in its passage hauls up the weight; the motion of the bogie is eventually arrested by means of a tripper fixed on the gantry in the boiler house, and its contents discharged through side doors into the bunkers. As soon as the truck is emptied, the balance weight falls, pulling it back and

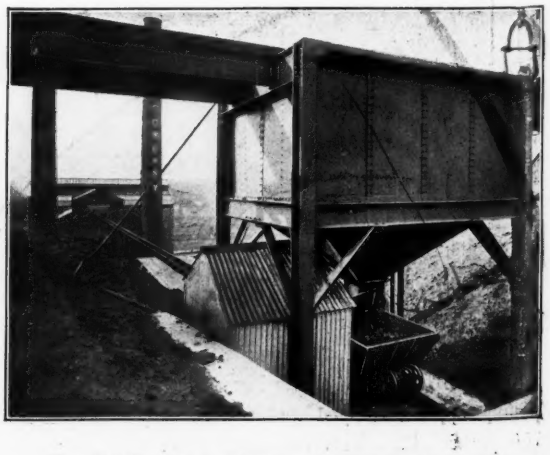


Fig. 7.—The Coal Hopper and Bunker Tramway.

imparting to it sufficient impetus to carry it back up the track to the filling hopper, which is shown in fig. 7.

The subsequent erection of additional boiler house units will, of course, involve the construction of similar bunker tramways and hoppers under the siding in each case.

The power house building, which includes a boiler house 70 ft. × 80 ft., and a turbine house 100 ft. × 50 ft., is a steel frame structure built on a floating concrete slab 3 ft. thick, stiffened, as usual, by a grillage of steel girders. This foundation forms the basement floor, and is some 9 ft. below the engine and boiler house floor levels.

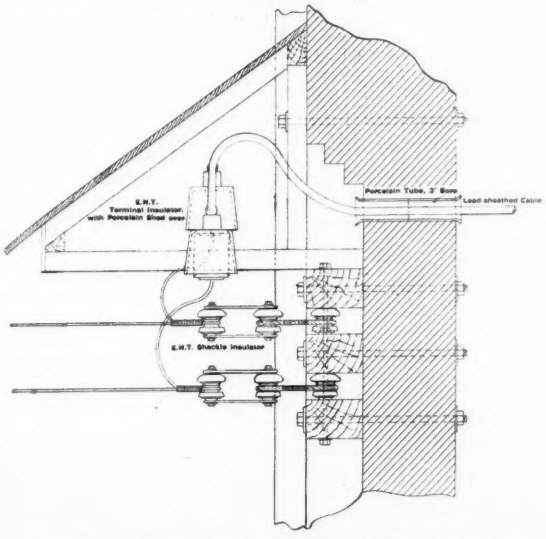


Fig. 8.—Showing the Junction of the Station Leads and Overhead Feeders.

The boilers are fitted with chain-grate stokers, which are motor-driven and fed in the usual way from the bunkers; the ashes and clinker are collected in hoppers under the

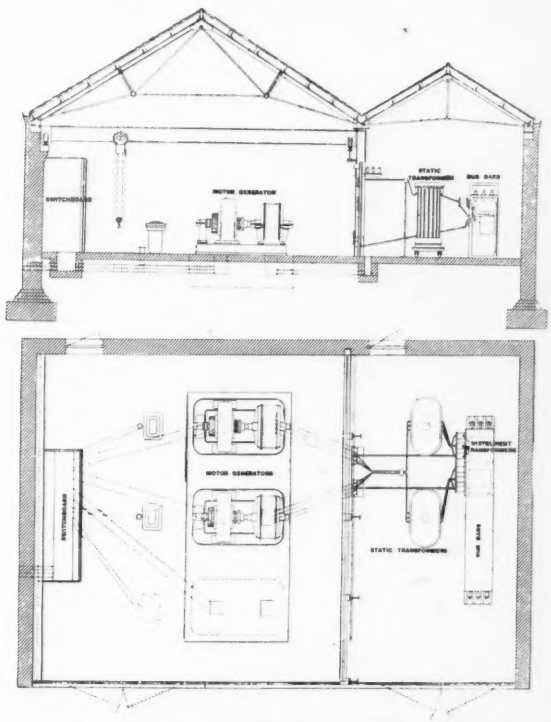


Fig. 9.—Showing the Type of Sub-Station for D.C. Supply.

The boilers are of the Babcock & Wilcox pattern, with a rated capacity of 20,000 lb. steam per hour each, at the working pressure of 160 lb. per sq. in., and 150° F. superheat, and are arranged in two banks of three on either side of the boiler house. Each bank is connected with its own flue, leading to a brick-lined steel chimney, 150 ft. high and 10 ft. diameter, situated at the end of the building.

grates, and from there distributed on to adjacent waste land by means of a miniature tramway.

Two vertical compound steam pumps, each with a capacity of 12,000 gallons per hour, are installed for boiler feeding in the boiler house. Two hot-wells are situated below them in the basement; the make-up feed is drawn from the public mains.

The boiler feed is pumped through two feed-water heaters *en route* to the boilers, no economisers being installed. The exhaust steam from the auxiliaries is utilised in the feed heaters, and as only the turbine exhaust enters the hot-wells, oil troubles are absolutely avoided in the boilers.

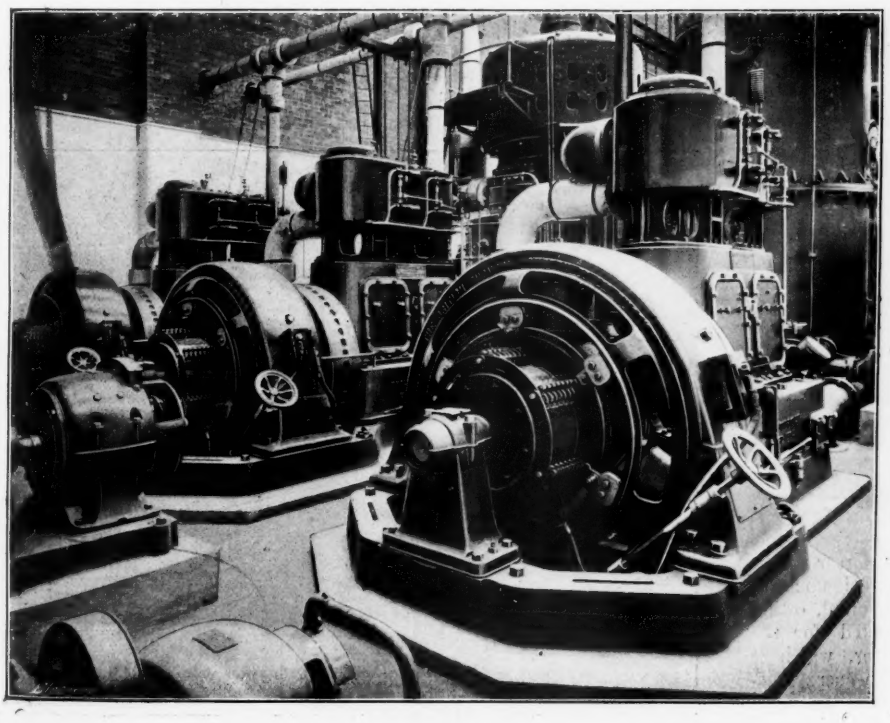


Fig. 10.—View of the Allen-B.T.-H. Exciting Plant.

The generating plant, of which an excellent view is given in fig. 4, consists of four Curtis turbo-generators, supplied by the B.T.-H. Co., each having a capacity of 2,000 kw., with a speed of 1,000 r.p.m., and supplying three-phase current at a pressure of 10,000 volts and 50 cycles to the bus-bars.

These turbines have been frequently referred to in our

pages (Electrical Review, February 26th, 1904; July 7th, 1905, &c.); they are provided with both mechanical and electrical regulation, the latter being controllable from the switchboard, if necessary; the method of governing is specially valuable where constant angular velocity and minimum speed variation are a *sine quâ non*. As is usual, the spindle of the rotating element revolves on a hydraulic footstep bearing supplied with water at a pressure of 400 lb. per sq. in. The hydraulic plant consists of two motor-driven three-throw pumps, one being spare, and an accumulator. If the hydraulic pressure falls below the working level, an alarm bell indicates the fact to the staff.

(*To be concluded.*)

Fig. 1.—Krieger Petrol-Electric Omnibus.

PETROL-ELECTRIC OMNIBUSES IN PARIS.

Of the nine trial omnibuses which made the service on the temporary line from the Bourse to the Grand Palais during a recent Paris Automobile Show, two were supplied with petrol-electric transmission, those of the Kriéger Co. and of Messrs. De Dion, Bouton. The Cie. Générale des Omnibus placed an order with Messrs. Brillié for a number of omnibuses with petrol motors, and this has now been followed by an order to the Kriéger Co. (Compagnie Parisienne des Voitures Electriques, procédés Kriéger) for their omnibus with petrol-electric transmission.

The principal characteristic of this system is that, owing to its flexibility, sudden stops and quick starts can be made with the greatest facility. The petrol motor is directly coupled through a flexible coupling to a direct-current generator, which supplies energy to two electric motors geared to the rear wheels of the omnibus; and there is no accumulator buffer battery required, owing to the arrangement adopted for the excitation of the generator, which is made self-regulating. The energy output of the generator is maintained constant, in spite of variations of pressure, the regulation being obtained by the following three methods of field excitation:—(1) A shunt winding derived from the brushes, varying according to the voltage; (2) a shunt winding connected to the terminals of a small battery; and (3) a series winding variable according to the load on the machine and differentially connected in regard to (1) and (2). The generator, which has six poles, is connected to a Richard Brasier petrol motor of four cylinders, giving 24 H.P. at 1,200 r.p.m.

The following are the principal characteristics of the omnibus:—

Wheel-base three metres.
Petrol-electric transmission.
Richard Brasier four-cylinder petrol motor, 100 mm. bore, 105 mm. stroke.
24 H.P. nominal rated output.
Two direct-current compound-wound motors, geared to rear wheels.
Arbel wheels, Falconnet-Perodeau tires.

The De Dion-Bouton firm, although they are building a number of omnibuses for London with their well-known petrol explosion motors, have proposed for the special conditions of Paris omnibus service a petrol-electric combination. The following are the principal characteristics:—

Wheel-base 3·7 m.
Front tires Pollack, rear tires (double blocks) Ducable.
Three speeds and reverse mechanism.
30-H.P. petrol motor, running at 1,400 r.p.m., magneto and spark-plug ignition.
Petrol-electric transmission.
Generator, compound wound.
Single motor, with two commutators. No battery used on the car.
Speed regulation obtained by modifications of the connections on the direct-current motor.
Two independent brakes.
Double chassis suspension, giving great elasticity.
Semi-cylindrical cover protecting engine and generator.

The weight of these petrol-electric equipments is somewhat in excess of the usual petrol engine drive, but it is claimed by the Kriéger Co. that the efficiency is not much, if anything, inferior to that obtained by the petrol drive, especially when considered in connection with the undoubted flexibility offered by the petrol-electric combination. The Kriéger Co. have supplied a number of ordinary touring cars fitted with their well-known transmission, but this is the first time that the system has been applied for omnibus service.

These new omnibuses will shortly be placed in service on the most difficult routes of the Cie. Générale des Omnibus comprising the well-known climb up to Mont-Martre.

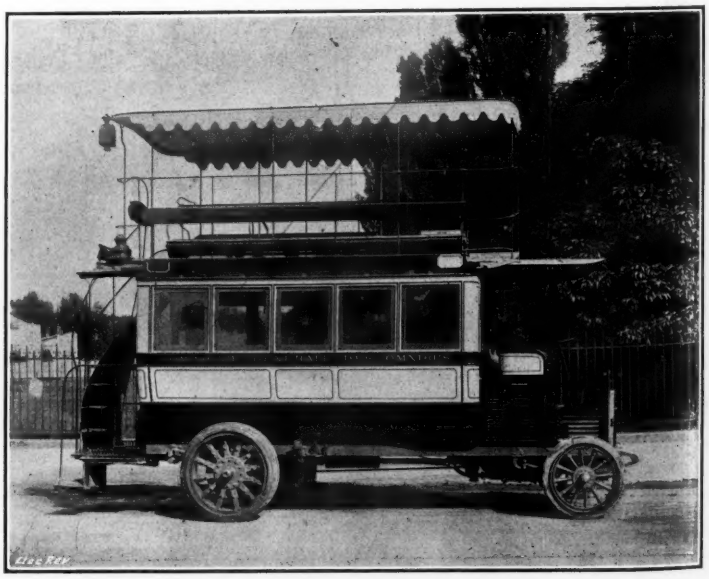


Fig. 2.—De Dion-Bouton Petrol-Electric Omnibus.

TRAMWAY and RAILWAY NOTES.

(*Concluded from page* 841.)

Manchester.—Following upon a recent protracted inquiry into the departmental organisation of the Manchester Corporation tramways, conducted by a special sub-Committee of the Tramways Committee, it occurred to the Tramways Committee that a rearrangement of the departmental system in relation to the rolling stock department was desirable. The Committee met on Tuesday afternoon last, when it was reported that Mr. J. Eades, who had held the position of rolling-stock superintendent, at a salary of £350 a year, had resigned his position, and the resignation, along with that of the foreman mechanic, was accepted by the Committee. The general manager, Mr. J. M. McElroy, presented a report, in which he recommended the division of the work of the rolling-stock department into two main branches, one of which should be conducted at the car-repairing works, and the other at the car-sheds. The new arrangement differs from the old in one respect only, and that is that a works manager is to be appointed to take charge of the car works, and to be subject to the control of the rolling-stock superintendent. The Committee adopted the general manager's report, and decided to advertise for a new rolling-stock superintendent and a new works manager, the former to have electrical and mechanical experience, and to be capable of taking charge of the entire works. It is understood that Mr. Eades resigned because he could not accept certain proposals put before him by the Committee.

At a meeting of the City Council last week, it was stated that the actual loss in connection with the parcels department last year was £5,500. This year the loss would be considerably less; perhaps about one-fourth of that amount.

Rochester.—It is expected that the new section of the Rochester Corporation electric tramways will be open for traffic by June 1st. Messrs. Dick, Kerr & Co., the contractors, hope to complete the work on the permanent way this week end. The overhead equipment is being carried out by the British Thomson-Houston Co.

Swinton and Pendlebury.—The U.D.C. has confirmed an agreement with the Salford T.C. for the transfer of the undertaking of the Manchester Carriage and Tramway Co. to Salford, which will lease it for 21 years. The price paid is £49,000.

Taunton.—Application has been made to the B. of T. for the transfer of the undertaking authorised by the Tramway Order, 1900, from the Taunton and West Somerset Electric Railways and Tramways Co., which is in liquidation, to the Taunton Electric Traction Co., Ltd., the consideration being £26,346 11s. 4d.

Walthamstow.—An order has been received from the Board of Trade extending the time for the completion of the work in connection with making junctions with the Leyton tramways for a period of twelve months from April 12th last.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—It is reported that the Belgian Telegraph Administration has decided in open competition the contract for the establishment at Antwerp of an underground telephone cable network, including all accessories. The contract, which has been placed with the Felten and Guilleaume-Lahmeyer Works Co., represents a sum of £72,800.

Canada.—The Government of Alberta has provided in the estimates a sum of $25,000 for preliminary work in connection with the establishment of a provincial-owned telephone system in this newly formed and rapidly developing province in the North-West of Canada. It is the intention of the Government to establish a long-distance system, leaving the local lines to municipalities.

Postal Telegraphs.—The Select Committee of the House of Commons which was appointed to consider the grievances of postal officials met again on the 17th inst., when Mr. C. H. Garland gave evidence on behalf of the Central Telegraph Clerks' Association. In the opinion of his Association, the present scale of pay was demonstrably inadequate. The demand formulated by his Association was as follows:—"That the remuneration of telegraph clerks in London shall be £50 per annum after 18 months' service, and then rise by annual increments of £7 10s. to £140, after which the annual increments shall be £10, until £230 is attained." The hours of duty should be reduced to seven daily. It should be within the right of a telegraphist to decline overtime—except on very extraordinary occasions, such as a breakdown—after he had performed a reasonable amount. They suggested that a fair limit for compulsory overtime should be six hours weekly and two hours on any one day.

Mr. Courtnall gave evidence on behalf of the officials in the cable room, and the Committee adjourned.—*Standard.*

Threatened Telephone Strike.—According to the daily Press, a dispute is in progress between the N.T. Co. and its operators, which may develop into a great strike. The questions at issue are connected with Sunday duty, rates of pay, and the hours of night operators. It is stated that the operators demand time and a half for Sunday work, and a reduction of the week's working hours to the same level as in the Post Office service. There are said to be 6,000 trade union operators in the country and 2,000 in London.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Beissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Cayenne-Pinheiro	Aug. 15, 1902	
Port Arthur-Chifu (Closed)	Mar. 7, 1904	
Tarifa-Tangier	Jan. 18, 1904	
Tangier-Cadiz	Feb. 18, 1906	
Cayenne-Paramaribo	April 20, 1906	
Sydney-Nelson	April 26, 1906	
Cap Haitien-Puerto Plata	May 15, 1906	
Landlines.		
Puerto-Barrios	Aug. 28, 1902	
Bachkale-Deliman	Feb. 12, 1906	

Wireless Telegraphy.—It is stated that a wireless telegraph station is almost completed on the north-east coast at Cullercoats. The station will be able to send or receive messages to or from a distance of 200 miles, and will receive messages on all systems.

The *Naval and Military Record* in a special article states that experiments have been made which have resulted in important improvements in the apparatus used for wireless telegraphy, and a new system of tuning has been introduced, with the result that the Admiralty is replacing the existing apparatus in use in the Navy with the new sets as quickly as possible.

At the request of the British Government, which suggested the postponement of the conference on wireless telegraphy until the autumn, and explained that it was not in a position to take part in it at an earlier date, the conference has been postponed from June 28th to October 10th.

It is stated that the railway accident at Spremberg, which took place several months ago, was the incentive to experiments which are now being made in connection with wireless telegraphy on the railways in Bavaria and Prussia, and which enable telegrams to be dispatched from stations to trains in motion. The necessary apparatus has been constructed by the Allgemeine Electricity Co., one set being placed in the station and the other on the locomotive. The trials have shown that it is possible to read plainly on the driver's platform the previously arranged telegrams or signs which are transmitted from the sending station—as, for instance, "Stop immediately" or "Drive back." Before the sign appears on the apparatus in the driver's cab the attention of the driver is attracted by the ringing of an electric signal bell. The experiments are regarded as having been successful.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—June 11th. The Austrian State Railway authorities in Cracow are inviting tenders until June 11th for the installation of an electric lighting plant at the railway station at Podgorze-Plaszow.

Birkenhead.—May 29th. Booster-balancer; switchboard extensions; and travelling crane for the Corporation electricity supply department. See "Official Notices" May 18th.

Clyde Navigation.—June 2nd. The Trustees invite tenders for the supply for one year of stores, including:—Asbestos and packing; electrical stores; india-rubber. Specifications on application to the Superintendent of Stores.

Colwyn Bay.—June 1st. Water-tube boiler, steam dynamo, condensing plant, for the Electricity Department. See "Official Notices" to-day.

Dublin.—May 28th. Fire signalling apparatus, annunciator, switchboard, internal wiring and fire alarm bells, for the Waterworks Committee. Specifications, £1, from the City Architect, Municipal Buildings, Cork Hill.

Dublin.—May 28th. Sub-station switchboards and accessories; transformer pillars; for the Lighting Committee. See "Official Notices" May 18th.

Finchley.—June 11th. Water-softening plant for the U.D.C. electricity works. See "Official Notices" to-day.

Folkestone.—June 1st. Electric fan for the Town Hall Committee Room. Mr. A. E. Nichols, borough engineer.

Glasgow.—May 28th. Electric wiring and fitting for the new St. Paul's Parish Church, John Street. Specification from Mr. Colin Young, 124, St. Vincent Street, Glasgow.

Govan.—May 30th. Stores for the electricity department. See "Official Notices" April 20th.

Gravesend.—Free and assisted payment wiring for the B.C. See "Official Notices" to-day.

Handsworth.—June 5th. Electric wiring, fittings, &c., for schools and education offices for the U.D.C. See "Official Notices" to-day.

London.—May 30th. Building, engineering and electrical accessories, for the Metropolitan Asylums Board. Offices, Embankment, London, E.C.

Mansfield.—May 30th. Battery and reversible booster; switchgear; for the Corporation. See "Official Notices" May 18th.

Nuneaton and Chilvers Coton.—June 12th. One 200-kw. steam dynamo for the U.D.C. See "Official Notices" to-day.

Pontypridd.—June 4th. Paper-insulated feeder and pilot cables for the U.D.C. See "Official Notices" to-day.

Port Elizabeth.—Tenders are being invited for the rewiring in insulated conduit of the premises of the South African Mutual Life Assurance Society. The work comprises over 600 lighting and motor points.

Portsmouth.—June 5th. 16 double-decked tramway motor-cars; also tramway feeder cables. See two "Official Notices" to-day.

Spain.—The *Gaceta de Madrid* of May 15th contains a notice inviting tenders, which will be opened 30 days after publication at the "Casa Consistorial," Trigueros, for the public lighting of that town by means of electricity for the term of 20 years. The light required for public purposes will be 1,200 c.p., distributed by incandescent lamps of 10, 16 and 25 c.p. A deposit of 273 pesetas (about £10) is required to qualify any tender. The *Gaceta* may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Spain.—The municipal authorities of Pinto (Madrid province) have just invited tenders for the concession for the electric lighting of the town during a period of four years.

Swansea.—May 29th. One 600-kw. c.c. steam generator with condensing plant, piping, &c., for the Corporation. See "Official Notices" May 4th.

Torquay.—June 1st. Condensing plant for electricity supply extensions. See "Official Notices" May 18th.

Worthing.—May 28th. Gas engine and producer plant for the Corporation electricity works. See "Official Notices" May 11th.

CLOSED.

Coventry.—The E.L. Committee has accepted the tender of Messrs. J. & H. McLaren & Co., Leeds, at £8,512, for two new engines, subject to the sanction of the L.G.B. being obtained.

Doncaster.—The Corporation has placed the order for 133 450-ampere-hour standard lighting cells in glass boxes, with Messrs. Pritchetts & Gold, Ltd.

Falkirk.—The T.C. has accepted the offer of the British Electric Plant Co., Ltd., for a steam dynamo. The engine is to be supplied by Messrs. James Howden & Co. Messrs. Wm. Wilson and Co., Ltd., Glasgow, are to supply an additional boiler.

Glasgow.—The Electricity Department has accepted the following offers for stores for the year:—

Single-concentric, triple-concentric, and low-tension cables.—Callender's Cable Co.
Extra high-tension cables.—W. T. Glover & Co., Ltd.
Small cables and flexibles.—W. T. Glover & Co., Ltd.
Meters.—Ferranti, Ltd., and Chamberlain & Hookham, Ltd.
Wood troughing.—Scottish Wood Haskenising Co.

Messrs. Crompton & Co., Ltd., and Mr. H. Tuchman have had divided between them the offer for carbons.

Govan.—The tender of the Lancashire Dynamo and Motor Co., Ltd., Trafford Park, has been accepted for the supply of motors for all sizes over 3 h.p. for the ensuing year; this is the third consecutive year that they have had the contract. The Adams Manufacturing Co., Ltd., have secured the contract for the supply of all motor starting rheostats required by the Corporation during the ensuing year. They are to be of the patent "Igranic" type. The tender of Electromotors, Ltd., Openshaw, Manchester, has also been accepted for the supply of continuous current motors from ½ to 3 h.p., both medium and slow speeds, for the forthcoming year.

Greenock.—The Corporation has placed contracts with the following firms:—

Two quick revolution engines to drive two 750-kw. dynamos.—Messrs. Belliss & Morcom.
Two 750-kw. dynamos and one 750-kw. motor-generator.—The British Westinghouse Co.
One surface condenser, to condense 30,000 lb. of steam per hour.—The Mirrlees-Watson Co.

London.—Stepney.—The E.L. Committee has received the following tenders for the supply of 25 large and 25 small cast-iron chambers for containing street disconnecting boxes:—

		Small.	Large.
E. & F. Wright	(accepted)	23s. 6d. each	31s. 6d. each.
John Every		32s. 4d. ,,	43s. 7d. ,,
J. Warner		37s. 9d. ,,	53s. 0d. ,,

Battersea.—The Lighting Committee has accepted the following tenders:—

Electric Construction Co., Ltd., additional panel to switchboard, £168 10s.
Moy, Ltd., reverse current circuit breaker, £44 12s.
Nalder Bros. & Thompson, Ltd., alteration of edgewise ammeters on existing switchboard, £34.
General Electric Co., Ltd., switchboard meter, £30.

Fulham.—The B.C. has accepted the tender of Messrs. A. C. Potter & Co., at £300, for new pumping plant for the artesian well at the electricity works.

Hackney.—The E.L. Committee has placed an order with Messrs. Nalder Bros. & Thompson, Ltd., for repairs to the battery regulating switches, at a cost of £95.

The following tenders were received for condensing water works in connection with the electric supply undertaking:—

T. W. Pedrette	(provisionally accepted)	£3,285
J. Moran & Son		3,529
George Hay & Co.		3,893
John Aird & Sons		3,981
Kirk & Randall		4,404
Hughes & Stirling		4,413
John Mowlem & Co.		4,520
Thomas & Thomas		4,528
T. Docwra & Son		4,784

Marylebone.—The B.C. has received the following tenders for pipe-work for the extension of the condensing system at the generating station:—

Jas. Sampson & Co., Ltd.		£1,493
John Cochrane & Sons		1,391
Babcock & Wilcox	(provisionally accepted)	1,375

Shanghai.—The contract for the switchboard required at the Shanghai Nankin Railway workhops has been placed with Messrs. Kelvin & James White, Ltd.

Walsall.—The T.C. has accepted the tender of the Stirling Boiler Co., Ltd., for a boiler for the electricity works.

Walthamstow.—An order has been given by the U.D.C. to Messrs. White, Jacoby & Co. to repair three armatures at the electric lighting station, at a cost of £130.

West Ham.—The Corporation on Tuesday accepted the following tenders:—

British Insulated & Helsby Cable Co., Ltd., tramway cables, from Canning Town power station to Stratford, £1,956 per mile (total cost approximately £3,650).
General Electric Co., changing one 600-kw. alternator, £815.
Babcock & Wilcox, Ltd., pipe-work for turbo-generator, £95.

Wigan.—The E.L. and Tramways Committee of the T.C. has accepted the tender of Messrs. Glover & Co., for the supply of cables.

Wishaw.—The E.L. Committee has accepted the offer of Messrs. Veritys, Ltd., for 50 wrought-iron swan neck street brackets, at 30s. 6d. each, and that of Improved Electric Supplies, Ltd., for 50 "Hebburn" brackets with fittings to take two tantalum lamps, at 30s. each.

FORTHCOMING EVENTS.

To-day's Events (Friday, May 25th).—At 5 p.m. Physical Society. Mr. J. S. Don on "Colour Phenomena in Photometry"; Mr. H. Tomlinson and Rev. G. T. Johnston, "Exhibition of an Automatic Arc Lamp"; Prof. H. A. Wilson on "The Theory of Moving-Coil and other Kinds of Ballistic Galvanometers"; Mr. A. Campbell, "Exhibition of a Bifilar Galvanometer free from Zero Creep."

At 3 p.m. Royal Institution. Prof. Sir James Dewar on "The Old and the New Chemistry." (Lecture II.)

At 9 p.m. Royal Institution. Mr. L. Hill on "Compressed Air and its Physiological Effects."

Friday, June 1st.—At 9 p.m. Royal Institution. Prof. H. Moissan on "L'Ebullition des Métaux."

Colliery Exhibition.—This exhibition opens at the Royal Agricultural Hall, Islington, on June 12th, and remains open until June 20th.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

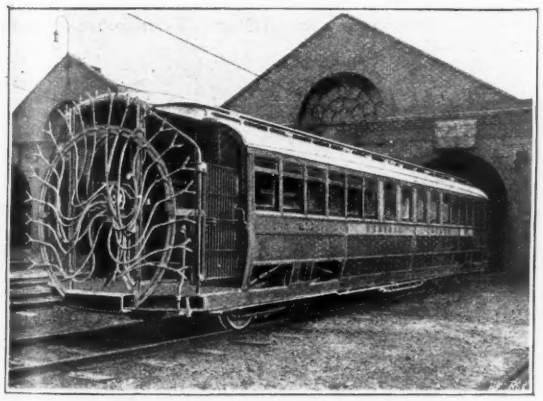
The following orders are issued:—

Thursday, May 31st.—Recruits for Camp parade at Paddington Station at 10 a.m.
Friday, June 1st.—All drills at headquarters cease until further notice.
Saturday, June 2nd.—Efficients parade at Paddington Station at 10 a.m. for Camp (Plymouth).

J. H. S. Phillips, Captain.
For O.C.E.E.R.E. (V.).

NOTES.

The Tunnel Whitewashing Machine of the Central London.—The accompanying illustration shows a machine which was designed by Mr. E. P. Grove, chief engineer of the Central London Railway, for the whitewashing of the tunnels of that railway. It has always seemed to Mr. Grove that lime washing would be an improvement, not only from a sanitary point of view, but he had an idea that it would have advantages both in cleanliness, light, and absorption of the CO_2 gases given off by the passengers. Inasmuch as the time in which the work could be done was so limited, it was evident that some kind of machine was necessary. After looking into various kinds of machines of the kind usually used for whitewashing, but of larger capacity and driven by power, it was eventually decided to try a hop-washing machine such as is used in the Kentish hop fields, and made by Messrs. Drake & Fletcher, of Maidstone. The machine, with some modifications, was mounted in one of the Central London experimental motor-cars, and as the photograph shows, the sprays and standpipe were fixed at the tail end of the car so that each of the 40 jets was approximately 18 in. from the iron walls of the tunnel. The pump which supplies the sprays at 90 lb. pressure is inside a small tank



Tunnel Whitewashing Machine on the Central London Railway.

just inside the car, and is driven from a 6-h.p. shunt-wound motor by belt and gearing, so that the operation of the pump stirs up the whitewash. The smaller tank is fed by a larger one holding 1,200 gallons of whitewash, which has been previously mixed in the water-softening tank at the depôt, Shepherd's Bush. With the motor-car travelling at about 2 miles per hour, about 850 gallons of whitewash are sprayed in 40 minutes, so that, even allowing for going twice over the work, it is possible to do a considerable portion of the tunnel each night. Previously to the whitewashing, the same machine was used for washing down two or three times with water so as to remove the dust which had accumulated. For more perfect work it is proposed, at some later date, to put the nozzles on a rocking frame so as to give them a movement of 18 in. or so in the direction at right angles to the jets. In practice the car comes up to the depôt two or three times a night for a fresh supply of whitewash. Mr. Grove asks us to state that he will be pleased to show any of our readers the machine and to give them any further information on the matter.

Society of Arts.—On Wednesday evening a paper on "The General Supply of Electricity for Power and other Purposes," was read by Mr. James N. Shoolbred, B.A., M.Inst.C.E.

The American Visit to Italy.—The *Western Electrician* says:—"It is to be regretted that owing to the small number of members of the American Institute of Electrical Engineers desirous of taking part in the Italian trip, which had been planned for this summer, a definite representative party cannot be formed. Suitable explanations have been made to the Italian Association, as it is not considered desirable to send a party of less than 15. Three or four members of the Institute will find their way to Italy this month, but not, we believe, in any way representing the society officially. About 20 members will take part in the trip to England."

American Electrical Manufactures in 1905.—The New York *Electrical Review* says that the director of the census has just announced the result of the tabulation of the statistics of electrical machinery and apparatus for the calendar year 1904, forming a part of the census of manufactures of 1905, taken in conformity with the Act of Congress of March 6th, 1902. The figures indicate that there has been a substantial increase in this industry in the United States, as compared with the statistics of 1900, which covered the fiscal year ending May 31st. Comparative figures for 1905 and 1900 are shown in the following summary:—

	1905.	1900.	Per cent. inc.
Number of establishments	783	580	35·0
Capital	$191,469,874	$83,130,943	130·3
Salaried officials, clerks, &c.: number	11,590	4,987	132·4
Salaries	$11,675,576	$4,563,112	155·9
Wage earners: average number	59,336	40,890	45·1
Wages	$31,226,721	$20,190,344	54·7
Miscellaneous expenses	17,934,878	6,788,314	164·2
Total cost of materials used	66,728,176	48,916,440	36·4
Total value of products	*140,614,481	91,348,889	53·9

* Exclusive of $17,335,033 reported as by-products of other industries, the aggregate value of electrical machinery and apparatus production for 1905 being $157,949,514.

The principal products are summarised as follows:—

Dynamos	$11,084,234	$10,472,576	5·8
Motors	22,370,626	19,505,504	14·7
Carbons	2,710,935	1,731,248	56·6
Incandescent lamps	8,319,159	4,036,112	106·1
Telephone and telegraph apparatus	16,974,892	12,154,678	39·7
Insulated wires and cables	34,519,699	21,292,001	62·1
All other products	59,171,047	33,490,464	76·7
Custom work and repairing	2,798,922	2,063,736	35·6
	$157,949,514	$104,746,319	50·8

Incorporated Municipal Electrical Association.—The annual convention of this Association will commence on Tuesday, June 19th, at Kingston-upon-Thames, where the president for the year, Mr. J. E. Edgcome, is the chief electrical engineer. After a welcome by the local Mayor, the president will deliver his address. According to the official programme, which has now been issued by the secretary (Mr. C. McArthur Butler), the following arrangements have been made:—

Tuesday, June 19th.—At Kingston-upon-Thames.
Paper on "Steam Turbines" (with lantern slides), by Mr. Sydney Baynes, chief electrical engineer, St. Pancras.
At 1 o'clock p.m.—Luncheon at Nuthall's, Ltd.
At 2 o'clock p.m.—River trip to Hampton Court in steam launches.

Wednesday, June 20th.—At Wharncliffe Rooms, Hotel Great Central, London (headquarters)
At 10 o'clock a.m.—Papers by Mr. S. E. Fedden, Sheffield; and Mr. H. Collings Bishop, Newport (Mon.), on "The Commercial Development of Electricity Undertakings."
Paper by Mr. J. F. C. Snell, Sunderland, on "Relative Economies of Electric Supply from Small Local Stations and from Power Companies."
At 2 o'clock p.m.—Visits to Lot's Road, Chelsea, power station, also London United Tramways power station at Chiswick.

Thursday, June 21st.—At Hotel Great Central.
10 o'clock a.m.—Annual general meeting, also a special general meeting, to amend articles of association.
2 o'clock p.m.—Visits to Charing Cross, West End and City Co.'s power station at Bow.
7.45 p.m.—Annual dinner.

Friday, June 22nd.—At Hotel Great Central.
10 a.m.—Paper by Mr. G. Wilkinson, Harrogate, on "Live Steam Heat Feed Water, its Effect on the Output and Efficiency on Steam Boilers."
Paper by Mr. W. H. Vignoles, Grimsby, on "The Efficiency of Steam Plant."
Paper by Mr. S. J. Watson, Bury, on "The Supply of Power to Tramways from Small Stations."
2 o'clock p.m.—Visit to L.C.C. power station at Greenwich.

Saturday, June 23rd. 11 o'clock to 1.—Visit to the National Physical Laboratory at Bushy House.
At 3 o'clock p.m.—Carnival and water sports.

The National Telephone Co.'s Annual Staff Dinner.—The thirteenth annual dinner of the staff of the National Telephone Co. was held at the Trocadero on Friday last. The principal officers of the company were gathered together from all parts of the United Kingdom, representing a staff of about 16,000, with Mr. W. E. L. Gaine, the general manager, in the chair. The guests included Mr. George Franklin, President of the company; Mr. S. H. Sands, vice-president; Sir James Fergusson and Sir James Woodhouse, directors; the Rt. Hon. Lord Kelvin, O.M., G.C.V.O.; Sir Albert Rollit; Major Shepherd; Dr. Grosvenor; Messrs. T. A. Welton, H. Fedden, Dane Sinclair, H. Laws Webb, H. H. Gaine, J. F. Bond, and others. Among other leading officials present were Mr. Albert Anns, secretary, and Mr. Frank Gill, engineer-in-chief; Messrs. S. J. Goddard, C. B. Clay (London), A. Coleman (Midland Province), J. C. Chambers (Northern Province), C. J. Phillips (South of England Province), R. Shepherd (North-Western Province), and F. Cowley (Ireland).

After the loyal toasts had been duly honoured, the Chairman, Mr. Gaine, proposed "The National Telephone Co. and the Board of Directors." Much had happened, he said, since they met in that room ten months ago; the agreement with the Postmaster-General which then awaited the sanction of Parliament had come into

force, and the policy of State acquisition of the telephones in 1912 had been settled. They must do all they could to work in harmony with the Post Office, and to facilitate the transference of the undertaking without inconvenience to the public. The directors had done all that was possible to make fair and just arrangements for the future of their large staff, and fortunately the staff had gained the ear of Parliament, and made out a strong and extremely good case, resulting in a favourable report on the part of the Committee, and reasonably fair terms from the Government to all but a small number; the latter were searching for the most picturesque and salubrious workhouses in which to spend the remainder of their days!

As for the progress made during the past 10 months, they now had 1,228 exchanges in the United Kingdom, an increase of 73; their subscribers' stations had increased by 50,000—say, at the end of 12 months, 60,000—a record increase, amounting to 15 per cent., the total number being 378,000. The messages transmitted numbered 1,052 millions per annum, an increase of 60 millions.

It was said that this country was behind all others; but the latest figures (up to January 1st, 1906) for European countries showed that, taking Austria-Hungary, Belgium, Denmark, Holland, Italy, Norway, Portugal, Russia, Spain and Switzerland, with a total population of 288 millions, compared with 42 millions in this country, the United Kingdom had 30,051 more telephone stations than all these put together—an excess of 7·2 per cent. Eight countries—France, Austria-Hungary, Belgium, Holland, Denmark, Norway, Portugal and Switzerland—together had 7,331 stations less than this country. (In the foregoing figures he had included the stations supplied by the competitors of the N.T. Co.). Taking the Scandinavian countries (Sweden, Norway and Denmark), and adding Belgium, Holland and Switzerland, Great Britain had 105,000 stations more than all these. The only country in Europe on the same platform with this country was Germany, with a population of 58 millions, and 10·2 stations per 1,000 inhabitants, compared with 10·15 in Great Britain and Ireland. Leaving out France, Germany and Sweden, no European country had so many telephones as London alone; London had nearly as many telephones, with a population of six millions, as the whole of France, with 39 million inhabitants; or the whole of Sweden, Austria-Hungary, and Belgium, with 60 millions; or Switzerland, Norway and Denmark, with 10 millions. Yet the telephone business had not developed as it might have, if it had had a fair chance; and there was another side to the picture—in America one did not use the telephone, one breathed it. The service there was not cheap and nasty, such as many advocated for this country, but scientific and highly developed, adequately paid for, and worth paying for. He could not claim that the telephone had developed in this country to anything like the extent in America. The legal decision that the telephone was a "telegraph" put it under the heel of the Government, which, until last year, never had a settled policy. Now that the policy was settled, he hoped to see what the company and its staff could do to develop the service as it ought to be developed. In America he had seen a contract signed by a "store" firm in Philadelphia for the establishment of a private branch exchange in a new store with 2,300 telephones; and one frequently found stores with 400, 500 or 600 telephones. That would come here in course of time. Why not yet? Because of the methods of charging in vogue. As long as they gave unlimited service for a fixed price, development would be restrained. The rates in America were based, as they should be, on the amount of service, and similar principles must be adopted in this country. Mr. Gaine referred to the journal started by the staff for the staff, of which he had great hopes, and expressed regret that Sir Henry Fowler, having accepted office in the Government, had resigned the presidency of the company. Mr. George Franklin was a worthy successor to him, and had before him a great task in the coming transfer of the business; Mr. Sands, and the rest of the board, were no less worthy of praise.

In reply to the toast, Mr. G. Franklin eulogised Sir H. Fowler, and said that the N.T. Co. was the most undeservedly abused and threatened of all public companies. He congratulated the staff on their having been able to secure fair treatment, and remarked that for 14 or 15 years he had watched and appreciated their work in various parts of the country. Mr. Sands also replied, expressing confidence in the future prosperity of the company.

Proposing "Our Guests," Mr. T. A. Prout (Liverpool) went back 3,000 years for a precedent, apparently to the days of Nebuchadnezzar, and paid a special tribute of affection and admiration to Lord Kelvin, referring to his scientific achievements and inventions.

Lord Kelvin replied in the three-fold capacity of a retired member of the staff, a *not*-retired shareholder, and as one of the guests. He referred sympathetically to the history of the struggles of the N.T. Co., and to the coming change, when the staff would be as loyal to the State as they had been to the company. Great as their success had been in the past, it would be greater in the future; they bore no ill-will whatever, and looked back to the past with pleasure, to the future with confidence. He wished perpetual success to the National Telephone Co., and he hoped that its name would be continued after the transfer to the State.

Sir Albert Rollit also replied with one of the excellent speeches for which he is famed, and paid homage to Lord Kelvin as the greatest modern master of pure and applied science. Mr. Franklin was also complimented, and the staff were exhorted to study science as well as their art.

Lastly, Mr. J. Sterling (Portsmouth) proposed the health of the chairman, expressing the pride of the staff in their general manager, together with their sincere affection and esteem. The toast was received with acclamation and enthusiastic musical honours, and was briefly acknowledged by Mr. Gaine.

During the dinner Farban's Viennese Band performed a programme of music, and afterwards Miss Lilian Gardner, Miss Jessie Jolly, and Messrs. A. L. Edwards and Wilson James contributed to the entertainment of the guests with songs, accompanied by Miss P. Adami.

Congresses at Milan Exhibition.—A large number of International Congresses will be held in connection with this Exhibition. Included among them are the following:—

May 24th to 29th.—Automobiles.
September 5th to 9th.—Electrobiology and Radiology.
September 23rd to 30th.—Engineers and Architects.
September 17th to 22nd.—International Union of Tramways and Railways.
Date not fixed.—Tramway Associations.

Fire Prevention.—The biennial International Fire Service Congress will be held at Milan next week, and a Special Commission of executive officers of the British Fire Prevention Committee has left London to attend this Congress.

Among papers that will be read by members of the British Fire Prevention Committee are one by Mr. Edwin O. Sachs, entitled "International Relations in the Fire Service and the International Fire Service Council"; one by Mr. Ellis Marsland, entitled, "The Different Systems of Fire-Resisting Shutters, &c., in Use to Protect Doors and Windows"; one by Mr. James Sheppard, entitled, "Fire Resistance of Buildings Constructed with Reinforced Concrete"; and one by Mr. Percy Collins, entitled "Fire Risks due to New Industries and the Motor Industry in Particular."

World's Rubber Production.—The *Financial News* says that the U.S. Consul Halstead, of Birmingham, quotes an estimate by two French experts, MM. Brenier and Claverie, that the total annual production of rubber throughout the world is 57,000 tons. Of this total, 55 per cent. came from South America and Africa. The French possessions on the West Coast of Africa produce 7,000 tons, and the French Congo 3,000 tons, while the output of the Belgian Congo does not exceed 6,000 tons. The consumption of rubber by the principal countries of the world in 1904 is stated as follows:—The United States, 26,470 tons; Germany, 12,800 tons; Great Britain, 10,000 tons; France, 4,130 tons; Austria-Hungary, 1,320 tons; Holland, 1,218 tons; Belgium, 748 tons; and Italy, 588 tons.

Electric Power for London.—Messrs. Kincaid, Waller, Manville & Dawson and Messrs. Harper Bros. & Co., the engineers for the St. Neots scheme, which was thrown out on the second reading in the House of Commons, have addressed to the *Times* a letter protesting against the misrepresentation of their proposals before the Parliamentary Committee which is considering the subject above named. They say:—

"We would not have encroached on your valuable space were it not for the fact that the Committee have asked for figures of the St. Neots scheme, so as to compare them with the London County Council proposals, and that these have been supplied by the expert witnesses called by the London County Council, who are partly responsible for their scheme.

"It need hardly be pointed out that the figures handed in by these gentlemen, who could scarcely have had the means to make themselves acquainted with the proposals of the 'Additional Company,' are entirely erroneous, and it is in order to correct these that we would request you to insert this letter in your valuable columns.

"Mr. Hammond gives the cost of the St. Neots scheme as £4,844,130, as against the actual estimates of their engineers of £2,000,000 in round figures. These estimates were based on the most careful investigations extending over many months, and on actual tenders received from firms of the highest repute for carrying out the whole of the works proposed in the Bill, or a saving, as compared to the County Council's proposals, of over £1,000,000.

"As regards working costs, the difference in the price of coal at St. Neots and in London, admitted by Mr. R. Hammond, taken on the estimated output of the St. Neots station, amounts to a saving of over £60,000 a year.

"The St. Neots scheme would have enabled electricity to be sold in London at a price below that proposed by the County Council, and at a satisfactory profit to the undertakers and without risk to the ratepayers."

Electric Railway in Chile.—H.M. Acting Consul-General at Valparaiso (Mr. A. L. Rowley) has forwarded a report on a concession granted to Senor Ambrosio Olivos, and lately purchased by the Compania Chilena de Inverciones, to construct an electric railway between Valparaiso and Santiago, *viâ* Placilla, Casa Blanca and Curacavi. A copy of the concession with translation is attached to the report, together with a plan of the projected railway. These may be inspected at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.—*Board of Trade Journal.*

Electricity in Agriculture.—The latest experiment with electricity on the growth of plants is that entered upon by Messrs. B. & R. Bomford, of Bevington, near Evesham, who are experimenting on 19 acres of land—12 sown with wheat and seven with barley. Mr. J. E. Newman, who is superintending Messrs. Bomford's experiment, hopes to get 25 per cent. more corn of superior quality with a corresponding increase in straw. To secure this, wires are suspended on poles 16 ft. high, and current generated by a dynamo driven by a 3-H.P. engine, and transformed to high pressure, is utilised.

Institution Notes.—Tramways and Light Railways Association.—The official circular for May contains a full report of the paper by Mr. G. H. Sheffield, on "Steel Rolling Stock," and the discussion thereon. It is understood that the amalgamation of the Association with the other two Tramway and Light Railway Associations is imminent.

Society of Chemical Industry.—On Monday at Burlington House, Prof. P. A. Guye, of Geneva, lectured on "The Problem of the Electro-Chemical fixation of Nitrogen."

Accident.—On Tuesday Mr. James Drinkwater, an electrician, of Manchester, had been attending to the batteries on board the steam yacht *Vagrant*, at Grimsby, owned by Mr. Chas. Markham, of Chesterfield, a director of the Great Central Railway Co. The work had been completed, and Mr. Drinkwater went into the battery room for a final inspection thoughtlessly striking a match instead of switching on the light. An explosion followed, and he was found unconscious, with his forehead cut and both eyes blinded. There is hope that the sight may be restored.

Ontario and Cheap Electric Power.—Our correspondent at Toronto, writing on May 10th, says:—"The much vexed question of electric power and the natural means of developing it, is once again the topic of the hour. During the past few days a Power Bill has been introduced into the Provincial House of Assembly, which has already passed into the Committee stage, and will, it is generally agreed, with but little amendment, shortly become law.

"The tenor of the Bill, which bears the title 'An Act to provide for the transmission of electrical power to municipalities,' may be briefly summarised as follows.

"The Government will appoint a permanent Commission, to be styled the Hydro-Electric Commission of Ontario, to oversee the relations between the existing power companies and the municipalities. This body will be empowered to fix the rates at which electricity shall be sold in the various portions of the province, and may, with the consent of the Crown, expropriate privileges already granted to private companies. The province will borrow money, to be expended by the Commission on the construction of transmission lines and distributing plants. Municipalities desiring to participate in the plan may enter into contracts with the Commissioners for the supply of power at rates which will include an allowance for transmission and transformer losses. The municipalities will eventually bear all the cost of the works. They will pay 4 per cent. interest on the expenditure, and an annual sum sufficient to form in 30 years a fund for the retirement of the securities issued to cover the cost. Lastly, they will contribute to the expenses of maintaining, renewing and insuring the works installed. Complaints that excessive rates are being charged for power, or that municipalities are discriminating in favour of certain manufacturers, may be heard by the Commissioners, who may direct what rates are to be paid for power.

"In the course of the debates, Mr. Whitney, the Premier, explained that from all the Government had been able to gather it was not anticipated that the drastic clauses of the Bill would ever have to be put into operation. The inference from this statement would be that the determined attitude of the Government has cleared up a situation, which at one time was somewhat threatening, and that the companies developing and transmitting Niagara Falls power, are already expressing their willingness to enter into agreements with municipalities and distributing companies at rates to be fixed by the Commission. In this connection the Hon. Adam Beck, the Minister in charge of the Government Electric Power Bill, announced last evening in course of debate, that one of the companies at Niagara had offered to supply energy at $11 per horse-power. Generally speaking, the Press and public approve the principle of the Bill, and it is confidently believed that the Government will have no difficulty in negotiating with existing companies so as to secure cheap power for the public, and at a price to allow a reasonable margin of profit."

Electrical Reduction of Vanadium Compounds.—Although the chief source of vanadium ores is Western Colorado, practically none has been used in America until quite recently, the whole having been shipped to Paris for the manufacture of ferro-vanadium. A plant has now been erected at Newmire, Colorado, by the Vanadium Alloy Co. for the production of vanadium steels. The ore contains from 2·5 to 6 per cent. of vanadium, and the process consists essentially of the following three steps. First the ore is crushed and roasted with common salt to convert the metal into a soluble form. This is followed by a leaching process and a precipitation of iron vanadate by means of green vitriol, whereby a product free from silica and other impurities is obtained. Finally this product is reduced in the electric furnace, and an alloy obtained containing from 20 to 50 per cent. of vanadium.—*Electrochemical and Metallurgical Industry.*

Electrical Production of Steel.—It was announced at the recent general meeting of the Electro-Steel Works Co., of Gurtnellen, Switzerland, that the steelworks established at Gurtnellen had been in operation for some time past, and that the results obtained had proved to be very satisfactory. The company uses the Kjellin process, and the quality of the steel produced is declared to be excellent. A scheme is now under the consideration of the company for the extension of the plant and the erection of another steelworks.

Appointment Vacant.—A third charge engineer is to be appointed by the Southwark B.C. at a commencing salary of £2 5s. per week.

Solomon's Method.—In the *Engineer*, of Chicago, a Mr. Cary writes to suggest a cure for smoky boilers. It is nothing less than to deprive the licensed engineer of his licence. Now, as pretty well, if not entirely, all the United States men in charge must hold a licence, if the smokiness were a fault of the plant design and not of the man, a succession of innocents would be deprived of their licences until such time as the plant got a fatal name, and no man would work there, and the plant would have to be shut down for lack of a licensed man to run it. Then the proprietor, by so much vicarious sacrifice of poorer brethren, would be made to see his errors, and would put his house in order. Meantime, the poor licensees would have to undergo fresh examination, so as to regain their licences. Such a procedure is worthy of Solomon, and must be allowed to possess, at least, the merit of effectiveness.

East Indian Railway Appointments.—*Indian Engineering* says that the cadre of electrical staff for the East Indian Railway is being increased by the appointment of an electrical inspector at Rs.450 and an electrical foreman at Rs.400 each per mensem.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Engineers.—In order to retain the services of the electrical engineer (Mr. R. F. Ferguson) the Hastings T.C. on May 18th decided, by 25 votes to 6, to increase his salary as from March 25th, 1906, from £375 to £450 per annum, rising by £25 a year to £600, subject to Mr. Ferguson undertaking not to apply for any other appointment prior to March 25th, 1912, the date when the maximum salary will be reached.

Mr. W. F. Duncan, of Norbury, has been appointed shift engineer to the Battersea electric lighting undertaking.

Mr. F. Purser Fletcher, A.M.I.Mech.E., A.M.I.E.E., station engineer-in-charge of both the metropolitan borough of Woolwich generating stations, has been appointed to a post with the Admiralty.

Tramway Officials.—On Thursday last week the staff and employés of the Sheerness and District Electric Power and Traction Co., Ltd., assembled at the main office for the purpose of bidding Mr. W. Donaldson, traffic clerk, farewell, on his leaving to take up the appointment of traffic and general depôt clerk on the South Metropolitan Tramways. Mr. Donaldson was presented with a silver cigarette-case. Mr. A. A. Watkins made the presentation on behalf of the staff.

Mr. John Eades, rolling stock superintendent of the Manchester tramways, has resigned, and the Committee have decided to appoint a works manager, who will have charge of the car works, but will be subject to the control of the rolling stock superintendent. This matter is mentioned in our "Tramway Notes" to-day.

General.—The *Financial Times* says that Sir Joseph Ward, Postmaster-General for New Zealand, who is now in London, intends inquiring into the various systems of wireless telegraphy, with a view to the establishment of a service in New Zealand, linking up the islands and lighthouses.

On Saturday last the erection staff of the British Westinghouse Co. assembled at the Red Lion Hotel, Kilburn, to do honour to their late engineer, Mr. T. C. Nesbitt. After dinner the chairman, Mr. R. C. Mayniham, chief engineer, handed to Mr. Nesbitt a set of drawing instruments. Mr. Knight, late chief clerk to Mr. Nesbitt, was presented with a gold signet ring.

Mr. Charles Lill, who has been for some time with the Armorduct Manufacturing Co., Ltd., as technical manager of their arc lamp and power department, has resigned his position with that firm, and is joining Messrs. E. P. Allam & Co.; he will devote special attention to country house lighting.

Obituary.—We regret to announce the death of Sir Thomas Richardson (of Richardsons, Westgarth & Co., Ltd.), which occurred on 22nd inst. at the age of 60.

NEW COMPANIES REGISTERED.

London and Continental Electric Carriage Co., Ltd. (88,803).—This company was registered on May 17th, with a capital of £120 in £1 shares, to carry on the business of manufacturers and repairers of carriages, cabs, omnibuses and other vehicles and boats, whether driven by electricity or other power, &c. The first subscribers are:—A. R. Wagg, Southsea House, Threadneedle Street, E.C., stockbroker, 10 shares: A. J. Schwelm, Southsea House, Threadneedle Street, E.C., stockbroker, 10 shares; A. Emerson, Stock Exchange, E.C., stockbroker, 1 share; N. C. Boot, Lyn Cot, Orpington, Kent, clerk, 1 share; W. G. P. Smith, 12, Cavendish Mansions, Clapton Square, N.E., clerk, 1 share; A. L. Hubbuck, 81, Priory Road, Kew, clerk, 1 share; and R. H. B. St. John, Meadowside, Grange Road, Bishops Stortford, Herts, clerk, 1 share. No initial public issue; the number of directors is not to be less than two or more than five; the first are A. R. Wagg and A. J. Schwelm; qualification, £10.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—This company was registered on May 14th, with a capital of £170,000 in £1 shares (140,000 "preferred and participating," and 30,000 ordinary), to adopt an agreement with the Punjaub Electric Traction Co., Ltd., and an agreement with Bruce Peebles & Co., Ltd., for the construction and equipment of certain tramways and an electric lighting and power installation in the municipality of Delhi, to construct or acquire, equip, own and work electric and other tramways, railways and other works, and to carry on the business of an electric tramway, light and power company in India or elsewhere. The first subscribers are:—Col. B. Scott, 109, Queen's Gate, W., 200 shares; J. M. Campion, Kufri, Amhurst Road, Ealing, W., M.I.C.E., P.W.D. India (retired), 200 shares; T. W. Stratford-Andrews, 18, Old Broad Street, E.C., managing director of Indo-European Telegraph Co., Ltd., 200 shares; B. Heyburn, 67, Mayford Road, Wandsworth Common, S.W., articled clerk, 1 share; A. W. Tait, Basildon House, E.C., chartered accountant, 200 shares; A. J. Side, Basildon House, E.C., secretary, 1 share; and A. W. R. Lovering, 70, Comerford Road, Brockley, S.E., clerk, 1 share. Minimum cash subscription, £100,000. The profits available for distribution are to be applied, firstly, in payment of a non-cumulative preferential dividend of 6 per cent. on the "preferred and participating" shares; secondly, in payment of a non-cumulative dividend of 6 per cent. on the ordinary shares; and thirdly, as to four-fifths of the remainder to the payment of a further dividend on the "preferred and participating" shares, and as to one-fifth thereof, to the payment of a further dividend on the ordinary shares. In winding up, surplus assets are to be applied firstly to repayment of capital on the "preferred and participating" shares; and secondly, to repayment of capital on the ordinary shares, four-fifths of any remainder going to the holders of the "preferred and participating," and one-fifth to the holders of the ordinary shares. The number of directors is not to be less than two or more than nine; the first are Col. B. Scott, T. W. Stratford-Andrews, J. M. Campion and A. W. Tait; qualification, £200; remuneration, £300 per annum for the chairman, and £200 each for the others. Registered office, Basildon House, Moorgate Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wells, Rayner & Co., Ltd., electrical engineers, London (78,655).—Issue, on April 24th, of £1,000 6 per cent. debentures, part of series created March 12th, 1906, to secure £2,000, charged on the company's property, present and future, including uncalled capital. No trustees. No previous issue of same series.

Chelsea Electricity Supply Co., Ltd. (20,468).—This company's annual return was filed on March 31st, when 49,436 ordinary and 6,000 preference shares had been taken up out of a nominal capital of £400,000 in 74,000 ordinary and 6,000 preference shares of £5 each. £5 per share has been called up on 37,770 ordinary and 6,000 preference, resulting in the receipt of £218,850. £58,330 is considered as paid on 11,666 ordinary. Mortgages and charges: £175,000 debenture stock.

Charing Cross, West-End and City Electricity Supply Co., Ltd. (29,122).—This company's annual return was filed on March 17th, when 80,000 preference, 80,000 ordinary, 80,666 City Undertaking preference and 70,000 City Undertaking ordinary shares had been taken up out of a nominal capital of £2,100,000 in 130,000 preference, 130,000 ordinary, 80,000 City Undertaking preference and 80,000 Undertaking ordinary shares of £5 each. £5 per share has been called up on the preference, ordinary and City Undertaking preference, resulting in the receipt of £1,200,000. £350,000 is considered as paid on 70,000 ordinary. Mortgages and charges: £486,000 4 per cent. debenture stock and £472,000 City Undertaking 5 per cent. bonds.

Oxford Electric Lighting Co., Ltd. (34,685).—This company's annual return was filed on March 23rd, when 20,000 ordinary shares had been taken up out of a nominal capital of £150,000 in 20,000 ordinary and 10,000 preference shares of £5 each. £5 per share has been called up on 13,200 shares and £67,550 has been received, including £1,550 paid on 310 forfeited shares. £34,000 is considered as paid on 6,800 shares. Mortgages and charges: £50,000. (2,907 preference shares have since been allotted, subject to payment in cash.)

Hove Electric Lighting Co., Ltd. (36,942).—This company's annual return was filed on April 6th, when 15,000 shares had been taken up out of a nominal capital of £100,000 in 20,000 shares of £5 each. £5 per share has been called up on 13,000 and £3 on 2,000, and £72,008 has been received, including £1,008 paid in advance of calls. Mortgages and charges: £44,000.

Northwich Electric Supply Co., Ltd. (46,958).—This company's annual return was filed on March 13th, when 3,629 shares had been taken up out of a nominal capital of £25,000 in 5,000 shares of £5 each. £18,145 has been received. Mortgages and charges: £11,400.

Howard Asphalt Troughing Co., Ltd. (formerly "Howard Conduit Co., Ltd.") (69,270).—This company's annual return was filed on April 14th, when 1,007 ordinary and 1,000 deferred shares had been taken up out of a nominal capital of £20,000 in 19,000 ordinary and 1,000 deferred shares of £1 each. £7 has been received and £2,000 is considered as paid. Mortgages and charges: Nil.

CITY NOTES.

West India and Panama Telegraph Co.

THE meeting was held on Wednesday at Winchester House, Mr. W. B. Kingsford presiding.

The CHAIRMAN, after referring to the death of Mr. W. S. Andrews, who was for many years associated with the company very intimately first as director and afterwards as chairman, said that the receipts for the half-year were £895 in excess of the corresponding period of 1904, and the expenses were £1,810 more. They would recollect that in the period with which they were comparing, their expenses were decreased by the sum of £4,000 received from the Cuba Co. for the charter of their steamship the *Henry Holmes*. During the half-year under review they had received nothing of that special character. Several interruptions of the cables occurred in the early months of this year caused, to some extent as they had good reason to believe, by the earthquakes which then took place. In those exceptional circumstances, they felt that it would be impossible for their own ship to alone overtake the repairs, and, accordingly, they at once chartered the cable ship *Cambria*, belonging to the Telegraph Construction and Maintenance Co., and sent her to the West Indies in March. He was very glad to be able to report that she succeeded in doing the work assigned to her, not only with thorough efficiency, but very promptly. They had thought it well to strengthen the board by inviting Sir John Cameron Lamb to become a director of the company, and they felt sure that his long experience and ability as a former secretary to the Post Office, and his intimate knowledge of telegraphic affairs, would be of very great advantage to them. Last May he intimated to the shareholders that they had been in confidential communication with the Government with reference to extending the cable system in the West Indies, and that they had made certain proposals which, if carried out, would involve the granting of an Imperial subsidy, but that under the new National Defence scheme, the then existing Government decided to withdraw the white infantry from the West Indies, and discontinue the maintenance of St. Lucia as a naval station. The consequence was that under those altered circumstances the Colonial Office informed them that their proposal could not be entertained, as it involved the granting of an Imperial subsidy. The Colonial Office also informed the West India Committee to the same effect, adding that the Colonies must meet from their own resources the cost of any improved telegraphic services. There the question rested for a few months. Last July the West India Committee asked them to furnish them with a copy of the proposals which they had made to the Colonial Office; but in view of the fact that those proposals were strictly confidential, they declined to do so. They were then invited to attend a meeting of the Cable Sub-Committee of the West India Committee. At that meeting they were asked to submit proposals for strengthening the West India cable communications, and that they did. Their proposals were to lay cables from Jamaica to St. Lucia, from St. Lucia to Barbados and from Barbados to Demerara for annual subsidies varying in amount according to the number of years for which they were granted. At that time they had no notion that the sub-committee were also in communication with the Direct West India Co. After some correspondence the sub-committee on December 19th last sent them a proof copy of a report, in which they recommended that the following new cables should be laid by the Halifax and Bermudas and the Direct West India Companies—from the Bermudas to Barbados, from Barbados to Trinidad and from Barbados or Trinidad to Demerara, with a connecting cable between the Leewards and the Windward Islands and Barbados. Having learned for the first time the nature of those proposals, they at once wrote to the sub-committee, requesting that no action should be taken until they had had an opportunity of reconsidering their position. Beyond a mere acknowledgment of their letter they heard nothing until January 5th, when the West India Committee sent them copies of their report, and informed them that they had sent them to the Colonial Office and to the principal commercial bodies in the West Indies, and they added that they did not consider it desirable to delay their transmission to the Colonies, but that they would consider any further suggestion they might have to make on behalf of the West India and Panama Co. They immediately communicated with the Colonial Office, calling attention to the extreme gravity of their position, asking for an opportunity of placing the whole matter before Lord Elgin, and requesting that in the meantime no action should be taken. Not only so, but they sent telegraphic instructions to their general superintendent in the West Indies to communicate by wire with the governors and principal commercial bodies there, urging them to suspend the consideration of the recommendation of the West India Committee until they had received further proposals from them. Those proposals were made the subject of a memorandum signed by him as chairman, copies of which were sent to the Colonial Office, to the Governors of the West India Colonies, and to the commercial and agricultural bodies in the West Indies. While that was going on, it had come to their knowledge that the Governor of the Windward Islands—Sir Robert Llewelwyn—had made a speech in the Legislative Council of Grenada of a most startling and extraordinary character. The question under discussion was that of the reduction of the subsidy payable to them by Grenada, in regard to which a recommendation had been made by the Agricultural and Commercial Society of that island that the subsidy should be retained at its old amount. In the course of his remarks, the Governor said that the principal object of the Government was to force matters to a head. He said there could be no doubt that the service which they supplied was unsatisfactory, and they hoped to force the company into liquidation so as to make room for an all-British Co. He continued, that he had been following the financial position of the company, and that it could no longer borrow money for new cables or make repairs. He (the chairman) made a very strong protest to the Colonial Office, and on April 5th he addressed a letter to Lord Elgin pointing out that the company had not had occasion to borrow money for many years, nor did it need to do so at the present moment, as its investment reserve stood at over £100,000. He expressed the hope that Lord Elgin would call upon the Governor to unreservedly withdraw the statements he had made, or to take such other notice of the speech, as the gravity of the occasion required. They had taken steps to let the Colonial Office know that they did not acquiesce in the reduction of the Grenada subsidy, and to urge that it should be restored to its former amount. They had also taken every means in their power to bring about a restoration of the St. Vincent subsidy. He felt it his duty to follow up his letter of protest by a personal interview at the Colonial Office, at which he was accompanied by Sir J. C. Lamb, and they took the opportunity of urging the claims of the company to favourable consideration generally. In spite of the letter from the Colonial Office of March 24th, 1905, in which they were informed that the

proposal could not be accepted, because it involved a grant from Imperial funds, it had recently come to their knowledge that the Colonial Office were in fact considering the question of entering into an agreement with the Direct West India Cable Co. to lay cables from Bermuda to Demerara by way of Barbados and Trinidad, with a view to securing all-British communication and lower rates. He need hardly point out to them how very injurious to the interests of their company the carrying out of such a project would be. It would not only have the effect of withdrawing some of the business on which, as a matter of course, they relied, but it would also inevitably lead to the abolition of subsidies. In view of that serious position of affairs, they at once communicated not only with the Colonial Office, but also with the Treasury, the Admiralty, the War Office, the Post Office, and the Cable Landing Rights Committee. They might rest assured that they had been, and were, doing everything in their power to resist the unjust attacks which were being made on the position of an old-established British company like theirs, with over 1,800 shareholders. Their company had continuously carried out its work in the West Indies for 36 years, doing its very utmost to keep the system in efficient working order, and, as a matter of fact, at the present moment there was no interruption of communication throughout the whole of their system.

Mr. H. Holmes seconded the motion, and the report was adopted.

The Paris Metropolitan Railway Co.

The report of the directors of the Compagnie du Chemin de Fer Métropolitan de Paris for 1905, first refers to the constructional works undertaken by the municipal authorities in regard to the new tunnels, and to the works carried out by the company. It appears that line No. 3, from Courcelles to Ménilmontent, which was partially opened to traffic in 1904, was entirely thrown open on January 25th, 1905, while the section between the Passy Station and the Place d'Italie was inaugurated in April of the present year. During the year cables were laid from the Saint Denis Station of the Société d'Electricité de Paris to certain of the company's substations, and extensions of mains were also made from the company's Beray station, so that supplies are obtainable from two sources. The question of the ventilation of the underground sections of the railway has engaged the attention of the directors, who proceeded to consult an expert on the subject. Before proposing a general solution, the expert was of opinion that experiments should be made at convenient points, and, as a consequence, the directors applied to the municipal authorities for permission to make large openings in the roof of the tunnel near the Belleville station and inside the Rome station, and to erect at the Place de Ternes a chimney shaft containing a ventilating fan to drive back the air in the direction of the Etoile station. The necessary sanction has now been received, and the work will be carried out early this summer. An arrangement has been made for the construction of passenger lifts at stations where the underground platforms are 40 ft. below the street level, one half of the cost of construction and working to be borne by the municipality and the other half by the company. The following items are extracted from the accounts for the past year:—

Share capital	£3,000,000
Total revenue	£1,062,381
Rental paid to municipality	£235,876
Working expenses	£454,139
Dividend per £10 share	15s. 2d.
Mileage worked	19¾
Number of motor cars in service	305
Number of trailers in service	378
Number of tickets issued	148,700,821

The profits realised in 1905 were over £48,000 greater than those obtained in the previous year, when a dividend at the rate of 16s. per £10 share was paid on 200,000 shares. The dividend of 15s 2d. declared for 1905 is, however, payable on an additional 100,000 shares and, in fact, on the whole of the share capital of £3,000,000.

Craigpark Electric Cable Co.

The third annual meeting was held in Glasgow on May 10th, Mr. J. T. Tullis presiding. In moving the adoption of the report, he remarked that last year they were looking forward with a certain degree of confidence to the future of the company, and up till the present their expectations had been realised. They all knew about the unfortunate action that had taken place regarding the patent in the golf ball business, and they had thought it advisable to refrain from manufacturing a ball that their managing director had produced. So far as the making of electric wire was concerned, they had had great trouble in fighting a combine, out of which they had held. However, it was possible that some move might take place, whereby they might join, and have the competition arrested. The expense of the extra cost of raw material had militated against that section of the business, and his hearers would be glad to know that Mr. MacLean had produced for them a certain class of wire which had been accepted by the most critical experts. It was proving to be a very fine class of wire indeed. Although the competition had been keen, they had managed to make their position to-day stronger than it had ever been before. They had had their troubles to contend with, but they seemed to be passing away, and they were now sailing into smooth water. He could predict with great confidence that next year would show a larger profit than last year.

The report was adopted.

Mr. Claud Hamilton was reappointed a director.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Consolidated Electrical Co., Ltd.—110,000 ordinary shares of £1 each, fully paid, Nos. 1 to 110,000.

Malacca Rubber Plantations, Ltd.—95,000 7½ per cent. participating cumulative preference shares of £1 each, fully paid, Nos. 1 to 95,000.

The Committee has appointed a special settling day as under:—

Wednesday, May 30th.—British Columbia Electric Railway Co.—Further issue of £100,000 deferred ordinary stock.

And ordered the undermentioned to be quoted in the Official List:—

British Columbia Electric Railway Co.—Further issue of £100,000 deferred ordinary stock.

India-rubber, Gutta-percha and Telegraph Works Co.—£400,000 4 per cent. debentures of £100 each, Nos. 1 to 4,000.

Long Island Railroad Co.—$4,517,000 additional guaranteed 4 per cent. refunding mortgage bonds of 1949, Nos. M 15,392 to 19,908, of $1,000 each.

Malacca Rubber Plantations, Ltd.—95,000 7½ per cent. participating cumulative preference shares of £1 each, fully paid, Nos. 1 to 95,000.

Urban Electric Supply Co.—Further issue of 30,000 ordinary shares of £5 each, fully paid, Nos. 100,001 to 130,000, and 20,000 5 per cent. cumulative preference shares of £5 each, fully paid, Nos. 80,001 to 100,000.

Yorkshire (West Riding) Electric Tramway Co.—40,000 ordinary shares of £5 each, fully paid, Nos. 70,001 to 110,000, and 46,261 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 1 to 46,261.

Prospectuses.—*Delhi Electric Tramways and Lighting Co., Ltd.*—This company has been before the public with an issue of 140,000—6 per cent. preferred and participating shares of £1 each at par. These shares will further be entitled to four-fifths of the surplus profits after 6 per cent. has been paid on the ordinary. The company's objects include the provision and operation of electric light, power, and tramway systems in Delhi under Government concessions that have been obtained. The existing installation which supplies current to the municipality for street lighting, will be acquired and developed. There will be some 10 miles of tramway track, for which, as well as for the erection and equipment of the power house, light and power mains, &c. Messrs. Bruce Peebles & Co., Ltd., have the contract at £103,000. Messrs. Kincaid, Waller, Manville & Dawson, of Westminster, and Messrs. Harper Bros. & Co., are consulting engineers for the scheme. There are to be 23 electric cars giving a 7½ to 15 minutes' service, with 733,000 car-miles worked per year. With an average fare per passenger per mile of half an anna, the receipts are estimated at 6½d. per car-mile, and the local working expenses are estimated at 3½d. per car-mile. Mr. T. W. Stratford Andrews, managing director of the Indo-European Telegraph Co., Ltd., has a seat on the board. The list of applications was to close on Monday last.

The Electric and General Assurance, Ltd.—This company has also this week been before the public with an issue of 45,000 £1 shares at 2s. 6d. premium. The directors are Messrs. P. G. H. Carvill, G. Cornwallis-West, J. F. Albright, and J. Devonshire, all of whom are connected with various tramway and electrical undertakings.

Rubber Estates of Ceylon.—For 1905 the profit and loss account shows a balance of £164, which is to be carried forward. The felling of forest for rubber planting is being vigorously proceeded with.

Rand Central Electric Works.—The report shows very satisfactory improvement. The revenue from supply of power and rent of plant amounted to £100,524; the total revenue was £102,824. The working profit was £54,410, or £5,959 more than in 1904. £24,097 has been carried to renewal account; and the directors recommend a dividend of 1s. 6d. per share (7½ per cent. per annum), carrying forward £12,338. The total power generated during the year was 10,688,925 KW.-hours, an increase of 422,515 KW.-hours. The new steam turbine has been in operation since June, and has proved satisfactory in its working. Having regard to the increasing demands for electrical energy in the Witwatersrand district, the directors contemplate important extensions of the company's plant, which will enable it to produce and supply power at a reduced rate, and enlarge the sphere of its operations. Negotiations are proceeding with the Transvaal authorities with a view to obtaining such a revision of the licence which will take cognisance of the altered technical conditions brought about by the progress of electrical science.

An Automatic Telephone Co.—Mr. Charles J. Avery, the secretary of the British Automatic Telephone Syndicate, announces that the board has received from Mr. Herbert Laws Webb, M.I.E.E., a full report upon the Lorimer automatic system of telephony. Mr. Webb has visited Paris on behalf of the syndicate, and after a full examination of the working of the Exchange there has made a very satisfactory report. In view of the nature of this report the board has decided at once to proceed with the formation of a company to manufacture the apparatus for this and other countries. As a further result of the experience gained the syndicate is negotiating for the Lorimer patent rights for various other countries. For some weeks past paragraphs have been appearing in the daily Press paving the way for this announcement.

Brunner, Mond, & Co.—The total distribution for the past year is 35 per cent., £190,718 is to be placed to reserve, and £2,500 to be written off patents account, leaving £62,943 to carry forward.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	*
Aberdeen	May 19	2,714	+ 180	51	68,069	— 208	14·4	..
Ayr	,, 12	435	— 31	52	14,604	— 114	8	..
Bath	,, 19	1,549	— 74	20	13,815	+ 1,860	13	..
Belfast	,, 18	6,356	+1,540	20	60,766	+15,334	40	+ 6½
Birkenhead	,, 20	1,986	— 8	7	7,467	+ 176	13·5	..
Blackburn	,, 16	1,956	+ 34	7½	7,763	+ 605	13·5	..
Blackpool Corp.	,, 17	1,028	— 171	7	5,107	+ 213	11·87	..
,, —Fleetw'd	,, 5	289	— 537	18	4,509	+ 226	8·25	..
,, —Lytham	,, 17	532	— 69	28	5,716	+ 616	7½	..
Bolton	,, 20	1,873	+ 163	7	14,854	+ 586	26	+ 1
Bournemouth	,, 16	2,999	+ 880	6½	10,711	+ 3,175	17·4	+ 7½
Bradford	,, 19	8,679	+ 212	7	31,595	+ 1,710	53	..
Brighton	,, 20	1,745	— 130	7	6,469	..	9·5	..
Bristol	,, 18	10,081	+ 167	..	..	..	28·5	..
Brit. Elec. Trac. Co								
Airdrie	May 11	434	+ 41	19	4,084	+ 419	3·65	..
Barrow	,, 11	443	+ 19	,,	4,059	+ 250	5·37	..
†Birmingham (City)	,, 11	10,483	— 867	,,	98,455	— 5,328	14·5	..
Birmingham (Mid.)	,, 11	2,747	— 889	,,	26,188	— 7,222	12·25	..
Devonport	,, 11	834	— 74	,,	7,917	— 423	8·85	..
Dudley—Sto'rb'ge	,, 11	1,518	— 93	,,	14,740	+ 220	21·25	..
Gateshead	,, 11	1,834	+ 110	,,	17,267	+ 847	11·25	..
Gravesend, N'fleet	,, 11	457	+ 9	,,	3,945	+ 172	6·5	..
Greenock	,, 11	1,247	— 1	,,	11,275	+ 742	7·25	..
Hartlepool	,, 11	522	+ 43	,,	4,910	+ 310	6·72	..
Leamington	,, 11	278	+ 174	,,	2,680	+ 1,291	3	..
Merthyr	,, 11	386	+ 3	,,	3,491	— 27	2·9	..
†Metropolitan	,, 11	6,390	+1,706	,,	57,092	+18,444	22	..
Middleton	,, 11	542	— 47	,,	5,770	+ 322	8·5	..
Oldham — Ashton	,, 11	1,074	+ 43	,,	10,006	+ 575	9·13	..
Peterborough	,, 11	220	— 42	,,	2,009	— 145	5·31	..
Potteries	,, 11	3,368	+ 160	,,	32,820	+ 1,797	29	..
Rothesay	,, 11	228	+ 34	,,	1,105	+ 333	2·75	..
Southport	,, 11	542	— 64	,,	4,864	+ 56	8·17	..
South Staffs.	,, 11	1,535	+ 202	,,	14,826	+ 2,288	13·87	..
Swansea	,, 11	1,551	+ 18	,,	14,151	+ 4,265	5·5	..
Tynemouth	,, 11	380	— 67	,,	3,465	— 65	3·75	..
Weston-s-Mare	,, 9	148	— 43	,,	892	+ 11	3	..
Wolverhampton D.	,, 11	775	+ 74	,,	7,339	+ 669	14·75	..
;Worcester	,, 11	518	— 72	,,	4,618	— 498	5·75	..
Yorks. Wool. Dist.	,, 11	1,718	+ 520	,,	15,849	+ 4,906	17	..
Miscellaneous	,, 11	3,831	— 40	,,	34,807	+ 123	..	..
Burnley	,, 19	2,263	+ 43	..	..	..	7·5	..
Burton-on-Trent	,, 20	549	— 68	7	2,073	— 161	8·5	..
Bury	,, 13	1,869	..	6	5,575	..	10·5	..
Cardiff	,, 12	3,759	— 28	6	11,886	— 529	15·87	..
Carlisle	,, 5	342	— 96	18	2,942	+ 90	..	..
Chatham and Dist.	,, 17	1,562	+ 107	20	11,259	— 105	9·33	+ 8
Colchester	Mar. 7	327	— 5	31	5,660	..	7½	+ ½
Cork	May 17	953	— 125	20	8,468	— 158	9·69	..
Darlington	,, 19	424	+ 50	7	1,442	+ 64	4·87	..
Darwen	,, 18	531	+ 50	7	1,774	+ 66	4·36	..
Dover	,, 5	388	— 63	5	1,159	+ 90	4·75	+ 1½
Dublin	,, 18	10,175	— 518	20	92,466	+ 1,415	48·5	+ ½
Dundee	,, 16	2,036	+ 383	52	49,497	+ 5,289	12·5	..
East Ham	,, 19	1,803	+ 107	7	6,510	+ 816	8	+ ½
Exeter	,, 18	518	— 288	7	1,883	— 358	4·25	..
Glasgow	,, 19	33,206	+1,731	50	785,376	+52,881	79·5	+ 6
;Gloucester	Feb. 21	221	+ 12	..	..	..	15	..
Halifax	May 16	3,060	— 103	7	10,791	+ 567	37	+ 1·5
Hastings	,, 18	1,308	..	..	..	..	..	..
;Huddersfield	,, 5	1,329	+ 70	5	7,514	+ 867	28	..
Hull	,, 19	4,246	+ 140	7	15,320	+ 117	13	..
Ilford	,, 19	969	+ 41	7	3,496	+ 204	6·57	..
Ilkeston	,, 16	255	+ 5	7	846	+ 2	3·5	..
Ipswich	,, 19	752	— 47	7	2,785	— 37	10·5	..
Isle of Thanet	,, 19	794	— 118	20	6,044	— 363	11	..
Kilmarnock	,, 19	347	— 23	1	..	..	4·12	..
Kirkcaldy	,, 16	424	— 18	..	..	..	7·5	..
Lan'kshire Trm.Co.	,, 17	1,778	+ 342	20	16,761	+ 3,736	12·5	+ 3·9
Leeds	,, 12	11,776	+ 581	6	36,722	+ 2,327	89·5	+ 8
Leicester	,, 19	4,479	+ 146	20	41,548	+ 4,020	..	..
;Leith	,, 5	445	+ 247	50	19,317	..	6	+ 1
Liverpool	,, 12	20,920	— 69	19	196,603	+ 5,468	104	+ 1
;L.C.C.	,, 5	49,566	..	5	132,776	..	18	—1·1
London United	,, 18	12,405	— 589	20	106,798	+ 5,221	..	..
Lowestoft	,, 19	242	— 40	34	4,356	— 262	3·5	..
Manchester	,, 19	25,572	+ 920	7	91,013	+ 4,463	84	..
Nelson	..	..	..	..	..	..	..	..
Newcastle	,, £	7,359	— 486	5	19,609	+ 837	25·5	..
Newport	,, 19	1,171	+ 26	7	4,228	+ 193	14·5	+ 1·5
Northampton	,, 18	845	+ 85	7	2,873	+ 76	5·5	..
Oldham	,, 20	3,423	+ 327	8	13,809	+ 781	28·75	+ 1·6
Pontypridd	,, 19	310	+ 5	7	1,215	— 43	3·5	..
Portsmouth	,, 19	3,523	— 142	7	12,880	— 258	14·5	..
Preston	,, 16	1,408	+ 195	..	..	..	10	..
Reading	,, 3	1,062	— 149	5	2,849	— 3	7·5	..
Rochdale	,, 19	1,589	+ 866	7	7,200	..	21·3	+ 5·8
Rotherham	,, 17	933	+ 95	7	3,226	+ 284	9·3	..
Salford	,, 14	8,503	+ 276	6	27,108	+ 439	58·9	..
Sheffield	,, 20	10,121	+ 557	8	40,736	+ 2,493	35·75	+ 1½
Southampton	,, 16	1,205	— 26	6½	5,992	+ 105	..	..
Southend-on-Sea	,, 16	647	+ 15	7	2,204	+ 87	6	..
†Stalyb'dge,Hyde,&c	Apr. 21	807	+ 100	3	2,456	..	21	..
Stockport	May 11	1,643	+ 479	6	5,420	+ 2,074	15·5	+ 4
Sunderland	,, 6	2,418	— 126	5	6,763	+ 484	10·57	..
Swindon	,, 16	363	+ 2	6½	1,240	+ 28	4·4	..
Tyneside	,, 16	818	+ 40	20	7,618	+ 475	8·87	..
Warrington	Mar. 29	677	+ 48	52	17,804	+ 1,247	6·57	+ ·25
West Ham	May 17	4,414	+1,162	7	15,719	+ 5,723	14·7	+ 8½
Wolverhampton	,, 16	1,622	..	..	..	..	10	..
Yorks. W. Riding	,, 20	1,520	+ 179	20	14,771	..	..	..
Baker St.-Waterloo	,, 19	2,700	..	10	14,589	..	3·25	..
Cen. London Rly.	,, 19	13,196	— 278	20	136,017	— 4,369	6	..
City & S. Lon. Rly.	,, 20	5,169	+ 128	20	57,263	+ 195	6·25	..
Dublin-Lucan Rly.	,, 18	221	— 25	20	1,962	— 119	7	..
G. N. and City Rly.	,, 19	3,552	+ 353	20	35,387	+ 1,629	3·5	..
L'pool Overh'd Rly.	,, 20	2,802	— 271	20	27,890	— 2,101	6·65	..
Mersey Railway	,, 19	3,499	+ 347	20	34,576	+ 2,069	4·5	..
Metropolitan Rly.	,, 20	30,513	—4,847	20	357,087	—17,664	70·5	..
Met. District Rly.	,, 20	16,110	+1,553	20	159,296	+ 9,773	24	..
Anglo-Argentine	,, 20	31,402	+ 4,261	20	301,684	+31,780	43	..
§Auckland	Apr.	10,083	+ 901	17	41,875	+ 2,211	18·64	..
§Brisbane	,,	11,452	+1,627	..	..	..	..	..
§Brit. Columbia Rly.	Mar.	14,746	+3,307	39	141,961	+37,294	..	..
Bu'n's A'r's E.T. Co.	Apr. 7	2,771	+ 553	14	19,791	+ 4,842	24	..
Bu'n's A'r's-Blgr'no	May 13	7,543	+ 178	19	67,966	+ 4,713	..	..
Calcutta	,, 19	5,581	+ 597	..	..	..	..	..
§Cape Electric T. Ld.	Apr.	16,072	..	..	..	..	..	..
§Geneva	,,	6,949	..	..	..	..	..	..
Perth (W.A.)	May 18	2,963	+ 243	20	80,386	+ 1,558	24·25	+ 5½

Compared with the corresponding period of 1905. † One week only.
Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES

Wednesday Afternoon.

For the authorities upon matters connected with the money market to talk cheerfully of a coming fall in the Bank Rate what time Stock Exchange business has fallen to a minimum, is very small consolation to the City. New issues, however, continue to brave the apathy of the public, and several more are on their way. There is little interest taken in any of the markets, and the changes overleaf, it will be noticed, are limited to small amounts.

Electric Lighting shares maintain a fairly firm attitude, but business is extremely quiet. Urban Preference fell $\frac{3}{16}$ to $4\frac{13}{16}$, following the drop of last week in the Ordinary shares. The recent report is responsible for the weakness of the Metropolitan companies' shares. Charing Cross City undertakings are flat at 4, and City Preference fell 10s. Amongst power issues, County of Durham Ordinary are $\frac{1}{16}$ up at $3\frac{1}{16}$. The South Wales Company seems to be in financial stress, and the utmost efforts are being made to hasten the obtaining of powers that shall enable the issue of fresh capital.

British Electric Tractions are the strongest in the traction group this week. The Ordinary are up $\frac{1}{8}$ to $6\frac{7}{8}$, the Preference $\frac{3}{8}$ at $9\frac{5}{8}$, and the Debenture a point at $115\frac{1}{2}$. These are all rises upon the top of advances a week ago, and the tone of the market has become much firmer. Buenos Ayres and Belgrano are hardening again, but London United Tramway Preference display fresh weakness, falling to 9, and the Debenture stock to $97\frac{1}{2}$.

Tramway Investments in Japan were treated in an interesting article in the City pages of last Tuesday's *Tribune*. Fares, according to the writer, are extremely low, and one can go 20 miles for as many farthings. Coming to the particular companies, he observes:—"The Kyoto Electric Railway shares, with a dividend of only 3·5, yet stand at 56 for 50 yen paid up. The Osaka-Kobe Electric Railway Company, which commenced operations last year, paid 6 per cent. on its first half-year's working, and the expectation of large future profits is shown by the fact that its 50 yen shares stand at 102·50, a rise from 64·20 since the line was opened. The paid-up capitals of these companies respectively range from 6,000,000 yen to 960,000 yen, with reserves varying from 289,000 yen to 55,000 yen. On the whole, they are well administered, and are favourite investments among the Japanese."

We have heard no dealing quotation yet for the Preferred shares of the new Delhi Electric Tramways and Lighting Company. They are investments which will appeal to only a certain circle, but some of the similar undertakings in other Indian towns are doing well. It would appear that the vendors make a profit of 90 per cent. upon the sale of the tramway order and the electric lighting business to the new company.

No animation is to be recorded amongst Home Railway stocks. Metropolitans are down to $68\frac{3}{4}$, but Districts keep fairly firm at 26. A feature of the week is the sharp fall in Great Western stock, a new issue of capital being rumoured, partly as the result of electric and motor traction enterprise (present and to come) of the company. Underground Electric Notes are quiet at $97\frac{1}{2}$, and the Central London, Waterloo and City, and City and South London prices have not changed. By the way, Parliament has been making steady progress this week with a number of Bills connected with traction concerns.

After the rapid rise in Direct United States shares, the loss of 10s., half their earlier gain, is quite natural. Anglo-American Telegraph Deferred, after being nearly a point lower, under the influence of sales by those with handsome profits to take, rose rapidly to $26\frac{1}{4}$. Amazon shares lost $\frac{1}{4}$, and the West India and Panama descriptions have fallen, the Ordinary $\frac{1}{2}$ and the Preference $\frac{1}{4}$. Indo-Europeans are £1 higher at 58. Globes keep their prices, and a point rise makes Submarine Cables Trust certificates $128\frac{1}{2}$. National Telephone Preferred is 1 better at $110\frac{1}{2}$.

Alterations in the manufacturing list include a 10s. rise in Callender's, which is equivalent to the recovery of the recently-deducted dividend. British Aluminium Funding certificates are down 2s. 6d., and Electric Constructions at $\frac{5}{8}$ are $\frac{1}{16}$ lower. But General Electric Preference improved to $9\frac{3}{4}$, though the Debenture stock fell off a point. The somewhat heavy decline in Willans and Robinson shares is due to the disappointing nature of the recent report. Vickers-Maxim shares have dipped to a few pence under 50s., the excuse being that investors are apprehensive of coming labour legislation which will cripple large employers. We serve but as echo to a market guess.

Buenos Ayres Electric Tramways Co. (1901).—

Mr. C. S. Grenfell presided at the annual meeting held at 78, Cornhill, on Friday last. He said that the great increase in profit was due to their having had the benefit of the operation of their system for a complete year. Their traffic was growing, and it would continue to expand with increasing profit. Their working expenses had decreased by 1d. per car-mile as compared with 1904. They had spent so much out of revenue on rolling stock that they had not thought further provision for depreciation necessary; they had provided a fund for debenture redemption.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905.	Closing Quotations May 16th.	Closing Quotations May 23rd.	Business done week ended May 23rd, 1906. Highest	Lowest.	Rise + or Fall —
17,700	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3⅜— 4½	3⅝— 4	..	..	— ½
155,600£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	5 %	83 — 88	83 — 88	83½	..	..
702,600	Anglo-American Telegraph	Stock	60/6	61s.	22½%	31½%	67 — 69	67 — 69	68	67½	..
3,148,700	Do. do. do. 5 % Pref.	Stock	6 %	6 %	5½ %	6 %	114 —115	114 —115	114⅞	114	..
3,148,700	Do. do. do. Deferred	Stock	1/-	2s.	Nil	1½%	25⅞— 26	26⅛— 26⅝	26 7/16	24 13/16	+ ⅜
50,000	Anglo-Portuguese Tel., 5% Mort. Deb. Stock Red.	100	..	..	..	..	101 —103	101 —103	..	..	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅞— 8⅛	7⅞— 8⅛	7 15/16	..	..
1,982,856£	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	96⅛— 98⅛	96⅛— 98⅛	98	97½	..
16,000	Cuba Telegraph	10	6¼%	10 %	5 %	5 %	8¼— 9	8¼— 9	8⅞	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %	17 — 18	17 — 18	..	..	..
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼— 9	8¼— 9	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103 %	100 —103%	..	..	..
60,710£	Direct United States Cable	20	8½%	8 %	8½%	8⅜%	16½— 16¾	15⅝— 16¼	16⅜	15⅞	— ½
70,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	142 —145	142 —145	144	142½	..
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	89 — 91	89 — 91	91	90½	..
1,848,772	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	106 —108	106 —108	107½	..	..
800,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	7 %	14 — 14½	14 — 14½	14⅜	14	..
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105½—107½	105½—107½	106⅝	..	..
800,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
180,887	Globe Telegraph and Trust	10	£3	5½%	5⅝%	5½%	11¼— 11⅝	11¼— 11⅝	11 5/16	11¼	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	14⅜— 15	14⅜— 15	14 15/16	14⅜	..
150,000	Great Northern Telegraph, of Copenhagen ..	10	12½%	15 %	24 %	24%	39 — 41	39 — 41	41	39⅞	..
42,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,300, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	13 %	56 — 58	57 — 59	58½	57 7/16	+1
251,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1⅛— 1⅜	1⅛— 1⅜	..	..	..
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	4 %	..	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	¾— 1	¾— 1	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 —111	110 —112	110½	110	+1
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %	108 —110	108 —110	108⅛	108¾	..
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	12 — 14	12 — 14	13⅛	12 5/16	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10 — 12	11⅛	11⅛	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	⅝— 5⅝	5⅛— 5⅝	..	..	+ ⅛
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..
1,689,593	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	104 —106	104 —106	104⅜	104½	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6¼%	6¼%	7½%	1⅜— 1½ xd	1⅜— 1½xd	29/-	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1½— 1⅝ xd	1½— 1⅝xd	..	..	..
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	..	4 %	99 —101	99 —101	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	5 %	7¼— 7⅝	7¼— 7⅝	..	..	..
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	..	4½%	103 —106	103 —106	..	..	..
3,201	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	126 —129	127 —130	..	..	+1
70,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7 — 7½	7 — 7½	..	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	110 —112	110 —112	..	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	4 %	9⅜— 10½	9⅜— 10½	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..
207,380	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	5 %	14 — 14½	14 — 14½	14⅜	14 1/16	..
75,000	Do. do. 6 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..
563,380	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —104	103 —106	103⅛	..	+2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/16— 1 1/16	7/16— 5/8	8/9	..	— ⅛
34,568	Do. do. 6 % Cum. 1st Pref.	10	7 %*	7 %*	6 %	5 %	8 — 8½	7⅞— 8¼	..	..	— ¼
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6 — 7	5⅞— 6½	..	..	— ½
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..

* Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

170,000	Anglo-Argentine Trams, 260,008 to 430,007	5	..	..	8 %	8 %	7 — 7½	7 — 7½	7⅛	7⅛	..
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	..	5 %	5 %	5½%	5⅞— 6⅛	5⅞— 6⅛	6 1/16	5 1/16	..
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	140 —143	140 —143	..	..	..
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	..	5 %	5 %	5 %	104 —106	104 —106	104½	..	..
800,000	Babcock & Wilcox, 1 to 530,000	1	..	17 %	20 %	20 %	3⅜— 4	3⅜— 4	79/4½	77/6	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	..	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	..	7 %	7 %	2⅛— 2⅜	2⅛— 2⅜	43/1½	..	..
40,000	Do. do. 7 % Cum. Pref...	5	Nil	Nil	7 %	7 %	5½— 6¼	5½— 6¼	6 3/8	6 1/8	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	6 %	6 %	5¼— 5½ xd	5¼— 5½ xd	5 1/4	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	4 %	4 %	3½— 4¼ xd	3⅜— 4¼ xd	72/0	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —104 xd	100 —104 xd	..	..	..
300,000	British Columbia E. Rail Def. Ord. Stock	100	..	6 %	6 %	6 %	116 —119	115 —118	116¼	..	—1
300,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	5 %	109 —112	109 —112	..	..	..
115,000	Do. 5 % Cum. Perp. Pref. Stock	100	..	5 %	5 %	5 %	107 —110	107 —110	109⅛	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	102 —104	102 —104	..	..	..
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	103 —106	103 —106	..	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	6½— 7	6⅝— 7⅛	7	6⅝	+ ⅛
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %§	9 — 9½	9⅜— 9⅞	9 11/16	9¼	+ ¼
1,415,423£	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	113 —116	114 —117	116	..	+1
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	4½%	93 — 95	93 — 95	..	..	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %	6¼— 6⅝	6¼— 6⅝	..	..	..
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝— 6⅛	5⅝— 6⅛	..	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	..	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	..	6 %	Nil	..	1⅞— 2⅜	1⅞— 2⅜	40/9	..	..
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	..	4 %	4 %	4 %	80 — 85	80 — 85	..	..	..
50,000	¶Brownett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞— 1⅛	⅞— 1⅛	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	2½%	⅜— ½	⅜— ½	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	6 %	1½— 2	1½— 2	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	84 — 86	84 — 86	85½	..	..
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	3 %	3 — 3⅛	3⅛— 3⅜	67/6	61/8	+ ⅛
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	6 %	5⅝— 5⅞	5⅝— 5⅞	5⅞	..	..
27,500	Do. "B" do. 1 to 27,500	5	..	6 %	6 %	6 %	5 — 5½	5 — 5½	5 7/8	..	..
317,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	106 —108	106 —108	107½	..	..
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	102 —105	102 —105	..	..	..
105,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	8 %	9¼— 9⅝	9¼— 9⅝	9⅝	..	..
32,610	Do. 105,001 to 137,610	5	..	..	..	8 %	8½— 9	8½— 9	..	..	..
350,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4½%	4½%	106 —108	106 —108	107	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	15%	10½— 11½	11 — 12	11⅛	11¼	+ ⅛
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¾— 6	5⅝— 6	6	..	..
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	108½—110½	108½—110½	..	..	..
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 %§	⅜— ½	⅜— ½	..	..	..
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..
280,211	Do. do. 4½ % 1st Mort. Deb. Stock	100	..	4½%	4½%	4½%	97 —102	97 —102	100	..	..
1,939,698	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	88 — 90	88 — 90	90	89½	..
530,316	Do. do. 4 % Pref. Stock ..	Stock	4 %	4 %	4 %	4 %	99 —101	99 —101	101	99½	..
530,316	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	77 — 80	77 — 80	79	78	..
1,480,000	City and South London Railway	Stock	3½%	2¾%	2½%	1⅞%	39 — 41	39 — 41	40	39½	..
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	2½%	2½%	..	2 — 2½	2 — 2½	..	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £80 Red.	..	5 %	5 %	5 %	5 %	97 — 100	96 — 99	97½	97	—1

perio of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	1905.	Closing Quotations May 16th.	Closing Quotations May 23rd.	Business done week ended May 23rd, 1906. Highest	Lowest.	Rise + or Fall −
260,000	Dick, Kerr & Co., 1 to 260,000	† 1	..	..	10 %	..	1⅜ — 1⅞	1⅜ — 1⅞	..	..	..
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	..	6 %	6 %	6 %	1 15/16 — 1 15/16	1 15/16 — 1 15/16	..	..	..
294,150	Do. do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	104 —107	104 —107	..	..	..
60,000	Dublin United Trams. (1896), 1 to 60,000	10	..	5½%	6 %	6 %	13⅜ — 14⅜	13⅜ — 14⅜	..	..	..
59,987	Do. 6 % Pref. between 1 and 60,000	10	..	6 %	6 %	6 %	14⅜ — 15⅜	14⅜ — 15⅜	..	..	..
63,400	Do. 4 % Debs.	100	..	4 %	4 %	4 %	99½ —100½	99½ —100½	..	..	..
800,000	Do. 3½ % "A" Debs.	100	..	3½%	3½%	3½%	97⅛ — 98½	95 —100	..	..	− ½
800,000	Do. 3½ % "B" Deb. Stock	100	..	3½%	3½%	3½%	94 — 96	95 —100	..	..	+2½
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	2 5/8	..	1¼ — 1⅜	1¼ — 1⅜	32/6	..	..
17,139	Do. "A" shares, 01—017,139	5	Nil	Nil	2 5/8	..	2⅜ — 3	2⅜ — 3	..	..	..
844,023	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..
100,000	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	90 — 95	90 — 95	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	1 1/16 — 1 1/8	½ — ⅝	11/6	..	− 1/16
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	2 — 2½	2 — 2½	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9⅜ — 9⅝	9½ — 10	..	..	+ ⅛
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	94 — 98	93 — 97	..	..	−1
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	..	3	4 %	4 %	3¾ — 3⅞	3¾ — 4	77/6	..	+ ¼
96,000	Greenwood & Batley 7 % Cum. Pref.	10	..	7 %	7 %	7 %	10½ — 11½	10½ — 11½	..	..	..
80,000	Do. do. 5 % Mort. Debs.	100	..	5 %	5 %	5 %	100 —101	100 —101	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	15%	12 — 13	12 — 13	12⅝	..	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5¼ — 5½	5¼ — 5⅝	5⅝	..	..
41,978	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	109 —111	109 —111	..	..	..
108,022	Do. do. Scrip. 50 % paid	..	..	..	..	..	57⅛ — 59⅛	57⅛ — 59⅛	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10%	5 %	10%	17 — 18	17 — 18	17 11/16	17⅛	..
37,500	†Liverpool Overhead Railway, Ord.	10	1⅛%	1⅛%	1¼%	Nil	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6½ — 7	6 — 6½	..	..	− ½
600,070	London United Trams (1901), 1 to 50,007	10	..	8 %	6 %	3 %	8 — 8½	7 — 9	8 1/16	..	− ¼
399,930	Do. do. 60,008 to 100,000 (£4 paid)	10	..	8 %	6 %	3 %	2 — 3	2 — 3	..	..	..
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	..	5 %	5 %	5 %	9¼ — 9⅝	8¼ — 9¼	9⅛	8⅞	− ⅛
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	97 —100	96 — 99	97½	97⅛	−1
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	3 %	⅛ — ¼	⅛ — ¼	..	..	..
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅞ — 1	⅞ — 1	19/3	19/-	..
850,000	Do. 4½ % Deb. Stock Red.	100	..	..	4½%	4½%	102 —104	102 —104	..	..	..
20,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	5	..	..	6 %	6 %	5 — 5¼	5 — 5¼	..	..	..
24,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	10	..	5 %	5 %	4 %	8 — 9	7⅞ — 8⅞	..	..	− ⅛
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	..	5 %	5 %	5 %	8 — 9	8 — 9	..	..	..
245,000	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	101 —104 xd	100 — 103	..	..	−1
37,850	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	15 %	32 — 34	32 — 34	33½	32½	..
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	101 —103	102 — 104	..	..	+1
8,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	96 — 97	96 — 98	97⅞	96⅜	+ ½
540,000	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3½%	99 —102	99 — 102	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	8½%	3 %	Nil	Nil	1⅜ — 2⅛	1⅛ — 1⅜	..	..	..
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	Nil	Nil	3 — 3½	2⅞ — 3⅛	60/-	59/4½	—
246,806	Do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	80 — 85	80 — 85	..	..	..

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	..	5 %	5½%	4 5/8 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..
60,000	Do. do. 4½ % 1st. deb. stock	100	..	4½%	4½%	4½%	101 —104	101 —104	..	..	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	10 %	8½ — 9½	8½ — 9½	8⅝	..	..
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8¾ — 9¼	8¾ — 9¼	..	..	..
800,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..
80,000	Charing Cross and Strand Electricity Supply	5	10 %	8 %	8 %	5 %	4 — 5	4 — 5	..	..	..
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	90/-	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	4 — 4½	3⅜ — 4½	80/-	..	—
40,000	Do. do. 1903	5	..	4½%	4½%	4½%	4 — 4½	3⅜ — 4½	82/6	..	− ¼
420,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102½	..	..
44,486	Chelsea Electricity Supply, Ord.	5	4½%	5½%	6 %	6 %	5½ — 5⅝	5½ — 5⅝	5½	..	..
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	6 %	10½ — 11¼	10½ — 11½	..	..	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	13 — 14	12½ — 13½	..	..	—
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —126	123 —126	..	..	..
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..
40,000	County of Durham Electrical Power, Ord.	2	4 %	4 %	£3 7 0	4 %	2⅞ — 3⅛	2 5/8 — 3 1/16	..	..	+
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½%	5 %	8 — 9	8 — 9	8⅛	8⅛	..
80,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	11½ — 12¼	11½ — 12½	11 15/16	11 11/16	..
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	109 —112	109 —112	..	..	..
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —102	100 —102	102	101½	..
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	5 5/8 %	3⅜ — 4⅛	3⅜ — 4⅛	81/3	..	..
80,000	Do. do. 6 % Cum. Pref.	..	6 %	6 %	6 %	6 %	4⅞ — 5⅛ xd	4⅞ — 5⅛	5 1/16	99/6	..
320,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	103 —106	103 —106	104	..	..
10,000	Folkestone, 1 to 10,000	5	..	5%	5%	5%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	..	5 %	5 — 5⅛	5 — 5⅛	..	..	..
75,000	Do. 4½ % 1st. Deb. Stock	100	..	4½%	4½%	4½%	101 —104	101 —104	..	..	..
13,000	Hove, 1 to 13,000	5	..	8½%	8½%	9 %	8¼ — 8⅝	8¼ — 8⅝	8 1/2	8 1/16	..
10,000	Do. New (£6 10s. paid)	£3	..	8½%	8½%	9 %	7 — 8	7 — 8	..	..	..
37,300	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..
7,300	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	95 — 98	96 — 99	..	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	12%	12 %	10 %	10 — 11	10 — 11	..	..	..
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	99	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3	4 %	2 — 2⅛	2 — 2⅛	4 1/16	..	..
60,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5⅛	5 — 5⅛	..	..	..
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..
200,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8½%	10 %	10 %	8¼ — 9⅛	8¼ — 9⅛	8 1/16	8⅛	..
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	4½%	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	..	..
220,000	Do. 4½ % 1st Mgrt. Deben. Stock	..	4½%	4½%	4½%	4½%	110 —114	110 —114	111½	..	..
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	95 — 97	95 — 97	..	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..
75,000	Newcastle-on-Tyne, 1 to 75,000	5	..	8%	8 %	8 %	7¼ — 7⅜	7¼ — 7⅜	..	..	..
75,000	Do. 5 % Pref., 1 to 75,000	5	..	5%	5 %	5 %	6 — 6¼	6 — 6¼	..	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	7½%	13 — 14	13 — 14	..	..	..
64,000	Do. do. 4 % 1st Mort.Deb.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..
18,500	Oxford, 1 to 96 and 407 to 18,810	5	..	6½%	7 %	7 %	6½ — 7	6½ — 7	..	..	..
50,000	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	99 —101	99 —101	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	12½%	10 — 11	10½ — 11½	10 1/16	10⅛	+ ½
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	96 — 98	96 — 98	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	4 %	2¼ — 2⅜	2¼ — 2⅜	..	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	13½%	8 %	4 %	4 %	3 — 3½	3 — 3½	6 1/16	..	..
103,700	South Met. Elec. Lt. & Power (Ord.	1	Nil	Nil	Nil	2½%	3/8 — 1/2	3/8 — 1/2	..	..	..
85,368	*(Late Blackheath and Greenwich* (7 % Pref.	1	Nil	7 %	7 %	7 %	1¼ — 1⅜	1¼ — 1⅜	..	..	..
148,292	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..
50,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	85/-	82/6	..
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4 3/8 — 5 1/16	4½ — 5	96/3	..	— 1/16
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	4½%	101 —103	101 —103	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13 %	10 — 11	10 — 11	10 11/16	10⅜	..
28,151	Do do. 4½ % Cum. Pref.	5	5 %	5 %	5 %	5 %	5 5/16 — 5 5/16	5 5/16 — 5 5/16	5 15/32	5⅜	..
	(Originally 5 %—Red. to 4½ % from 31st Dec., 1905.)										

Shares not officially quoted :—Mackay Companies, ord., 76—77. Pref. 75—76.
† Unless otherwise stated all shares are fully paid. ‖ Interim dividends.

(Bank rate of discount 4 per cent. (May 3rd, 1906).

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1906.

As might be anticipated, the April returns of electrical business do not come up to the excellent returns recorded in the previous month. The total of the exports was £109,619, which compares with £157,000 in March last; the imports similarly amounted to £127,969, as against £147,190; and the re-exports were £7,387, as compared with £13,337. Thus considerable reductions are apparent under all three entries, and the exports in particular are below the average obtaining in 1905, while the imports remain well above it.

In connection with the electrical exports, it is satisfactory to note the excellent position maintained by the electrical and electrically-driven machinery sections, which totalled £54,000, a figure slightly in excess of last month's; naturally other classes of goods show a reduction in value, particularly electrical cables, which reached the abnormal total of £57,196 in March, but have this month dropped to £17,498, a figure below the average.

With the exception of a slight increase in the importation of fittings, every section of the imports shows a considerable decrease as compared with the March figures.

The re-exports do not contain any special feature; although considerably reduced in value, they are still at about the average of last year's figures.

No tramway material, specified as such, is recorded in the past month's returns.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material and electric bells.	Electrically-driven machinery.	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark	128	573	32	8	126	576	2	...	1,490	...	...
Germany and German W. Africa	128	304	50	...	3	89	4	...	131	...	...
Netherlands	126	21	492	...	...	212	13	...	...	...	...
Dutch Borneo, Java and Indian Possessions ...	...	...	22	...	...	402	...	...	...	...	...
Belgium	67	304	121	29	14	209	227	...	768	...	...
France	218	...	53	10	20	866	297	...	...	140	...
French West Africa and West Indies	...	18	...	...	...	...	...	...	...	...	...
Portugal, Madeira and Portuguese Africa ...	66	381	...	214	4	...	26	...	139	345	...
Spain and Canary Isles	10	100	60	30	5	3,253	2	...	26	15	...
Italy and Austria-Hungary	...	...	86	...	406	518	...	...	...	...	...
European and Asiatic Turkey	3	30	...	...	...	...	...	...	...	...	...
Egypt	345	37	90	175	266	444	63	...	64	...	...
China and Siam	658	1,617	115	13	...	596	...	...	...	348	...
Japan	186	3,988	18	4,346	1,252	215	...	...	41	20	...
U.S.A. and Cuba	596	...	242	46	34	30	...	14	...	...	...
Mexico, Peru, Uruguay, Ecuador and Colombia	48	1,857	2	7	...	...	...	...	15	...	...
Chili	24	71	168	...	15	867	5	...	...	...	...
Brazil	106	89	57	174	...	1,120	20	...	6	...	...
Argentine	762	567	633	601	545	3,693	394	64	239	4,700	...
Channel Isles, Gibraltar and Malta	83	1,369	529	16	150	1,721	...	...	138	2,900	...
British West Africa and St. Helena	22	8	12	...	34	219	...	...	32	...	...
Cape of Good Hope	373	1,265	1,337	276	218	878	9	...	18	...	...
Natal	1,368	1,032	1,548	519	311	893	67	22	432	1,247	...
Zanzibar, Brit. East Africa, Mauritius and Aden	64	52	15	9	...	475	11	...	12	...	...
India	1,427	1,059	2,026	624	1,424	5,177	228	58	81	2,538	...
Burmah	168	2	31	17	...	5,709	15	50	...	...	...
Ceylon	73	7	178	108	75	14	20	...	9	...	...
Straits Settlements and Labuan	83	316	232	65	120	...	102	61	26	1,309	...
Hong Kong	39	61	25	...	4	1,676	3	...	...	1,150	...
West Australia	184	14	3	20	120	931	...	...	...	...	...
South Australia	24	160	75	...	...	78	93	...	...	1,750	...
Victoria	591	416	9	...	149	5,515	...	...	...	...	...
New South Wales	644	1,585	297	8	252	96	...	...	...	...	...
Queensland and Tasmania	45	...	10	...	16	132	...	...	...	...	...
New Zealand	474	195	238	9	432	1,048	...	14	172	9	...
Canada	112	...	61	...	...	3	...	...	...	...	...
British West Indies and British Guiana	14	...	41	...	...	47	38	...	26	...	...
Total, £	9,259	17,498	8,908	7,324	6,670	37,702	1,639	283	3,865	16,471	...

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	
Norway, Sweden and Denmark	109	207	...	65	...	1,149	100	....	10,065	...	...
Germany	3,255	13,117	756	167	72	8,103	590	866	1,925	...	...
Holland	1,540	3,320	240	3,992	60	205	38	5,144	1,140	...	...
Belgium	143	2,559	220	2,047	...	6,999	76	2,021	16,912	...	...
France	2,379	4,211	1,205	781	593	1,867	536	2,582	149	...	...
United States	2,102	1,301	2,685	98	35	19,882	41	176	99	40	...
Italy	...	5	...	...	...	...	...	...	...	...	...
Total, £	9,528	24,720	5,106	7,150	760	38,205	1,381	10,789	30,290	40	...

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	
Various countries, mainly as above	1,887	30	425	58	...	2,105	14	70	2,493	305	...

TOTAL EXPORTS: £109,619

TOTAL RE-EXPORTS: £7,387

TOTAL IMPORTS: £127,969

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

PARLIAMENTARY.

Shropshire, Worcestershire and Staffordshire Electric Power Bill.

MONDAY, MAY 14TH.

THIS Bill came before the House of Lords Committee, of which Lord Brougham and Vaux is chairman, on Monday, May 14th. The promoters were represented by Mr. Wedderburn, K.C., with whom were Mr. Hutchinson and Mr. Macassey. A large number of petitions were presented against the Bill, the most important of them being those of the Great Western Railway Co., Messrs. Foote and Milne, the Midland Electric Corporation for Power Distribution, the Birmingham Corporation, the Dudley Corporation, the West Bromwich Corporation, the Oswestry Corporation, and the Shrewsbury and Walsall Corporations. Several gas companies also petitioned against the Bill, as did a large number of urban and rural district councils.

In opening the case for the promoters, Mr. WEDDERBURN dwelt at some length on the advantages of electric power for all manufacturing and industrial purposes, and explained the history of the various power schemes. These schemes, he said, originated with the Midland Electric Corporation for Power Distribution, Ltd., which was mentioned in Lord Cross's Committee, and was concerned with the area with which his clients had to deal. The Corporation was now petitioning against this Bill, but no one appeared for them. The Bill, for which he appeared, was one which sought to extend the powers of his clients to a new area. By Clause 51 power was sought to supply two classes of people; first, authorised undertakers, or distributors as they might be called; and, secondly, persons desiring a supply for power. There was in a sub-clause a special proviso that the power was not to be supplied for lighting except to a person who took for power, and then the person must not take more for lighting than he did for power. The reason for that was that it had been suggested that if it was merely that a person taking it for lighting might also take for power, a man might take power merely for the purpose of boiling a kettle in his house, and then he might take from the company all the rest for lighting. Then there was the following proviso:—"The company shall not supply energy (except for power to authorised undertakers or to any railway, light railway or tramway, or water company, or proprietors or trustees of any canal or navigation) in any area which at the date of the passing of this Act forms part of the area of supply of any authorised distributors, without the consent of those distributors." That meant that the power company was to have no power at all in the district of an authorised distributor, whether local authority or company, except for canal and railway purposes, without their consent. Appeal to the Board of Trade was provided as to whether or no the local authority or company were unreasonably withholding their consent.

TUESDAY, MAY 15TH.

On Tuesday, May 15th, Mr. WEDDERBURN, continuing his speech for the promoters, said that the scheme which he represented before their Lordships had been one of gradual growth. In 1903 the company was incorporated to supply power in the Counties of Shropshire and Worcestershire, and their capital powers then were £300,000, with £100,000 borrowing powers. Learned counsel handed in a map to the Committee showing the area of the company. By the present Bill their first proposal was to improve and extend that area by taking in Shifnal and Rugely, which were left out in the Bill of last year. Then there was the taking in of the whole of the Midland Corporation's area. Not being a statutory power company, the Midland Corporation had no statutory powers, and he understood now that they were not opposing. Then it was proposed to take in West Bromwich, Birmingham, Walsall, Wolverhampton and Smethwick. They asked, further, for £600,000 additional capital and borrowing power of £200,000, which would give a complete total with their existing powers of £1,200,000. Mr. Wedderburn then dealt at considerable length with the opposition to the scheme.

Mr. G. L. ADDENBROOKE, consulting electrical engineer to the promoters and formerly engineer to the promoters of the Midland Electric Corporation, was then called. Examined by Mr. HUTCHINSON, he said that he knew the district which was proposed to be included in the Bill, and was acquainted with the conditions of manufacturing in the area. He had carefully considered the area and the position and the possibilities of development, and having done so, he had placed the matter before certain financial friends, who had employed him or supported him in other undertakings, and formed a syndicate, who were finding the money for the present promotion. Witness mentioned the following gentlemen as being interested in the scheme:—Mr. H. Ashford, a member of a large firm of accountants in Birmingham; Mr. Atkins, a large jobber on the Stock Exchange; Mr. Faithfull Begg; Mr. Cutler; Mr. Lacy; Mr. Holland, a director of the Cleveland and Durham County Electric Power Co. and the British Power Co.; Mr. J. MacDonald, Sir James Mackay, Sir Geo. S. Mackenzie, Mr. Duncan Mackinnon, and others. The capital of the syndicate was £10,000. Witness then bore out counsel's opening statement as to the area proposed to be supplied, and said that experienced men had called on every factory owner they could find and ascertained the horse-power he employed and the hours of working. In the North Worcestershire district there appeared to be some 43,000 H.P. employed, in Cannock Chase some 30,000 H.P., and in Shropshire 16,000 H.P. If they were to cover the whole of the district they might have to provide for nearly 250,000 H.P. Birmingham had, roughly, 50,000 H.P.; they had not been able to make an absolute census of the place.

Mr. Faithfull Begg, Mr. G. C. Howard, and Mr. A. W. Tate having given evidence on the financial part of the scheme, the Committee adjourned.

WEDNESDAY, MAY 16TH.

On Wednesday, May 16th, further financial evidence was given, and Mr. ADDENBROOKE was recalled to give evidence on the engineering aspects of the scheme. He said that the company could give a cheap supply under its old Acts, but a much cheaper supply if the present Bill were passed. The company proposed to acquire sites for two additional generating stations. The first of these was proposed to be put up on a site to the south of Birmingham, and the second near Hammerwich. Ultimately the two stations would be linked up with their two existing generating stations.

Mr. HONORATUS LLOYD, K.C.: Existing stations?

WITNESS said that the stations were authorised. The connecting up of the two stations with those already authorised was a matter of very great engineering importance, as it had been found that two, three, or practically any number of generating stations, could pump into the same mains. It enabled the burdens on the stations to be equalised, and provided each part of the area with a duplicate route. The fundamental basis of the whole scheme was that practically everything would have a duplicate method of supply by means of ring mains. Every factory would be approached from two directions, except the very small ones. The company also proposed to acquire water rights for condensing purposes. Steam turbines would probably be used for 10 or 15 years, when they might go on to gas. The Bill further sought to empower the company to enter into working arrangements with the Midland Electric Corporation, the Birmingham and Midland Tramways, and the Kidderminster and District Electric Lighting and Traction Co. With regard to the Midland Corporation the intention was first of all to take a supply of energy from that Corporation and supply the parts of the Shropshire district adjoining their territory. The agreement was to supply the company with 1,200 KW. In the future the company hoped to be able to reciprocate and supply the Midland Corporation with additional energy as they required it. There were a great many factories situated partly on the border and nearer one generating station than another, and reciprocal arrangement could be made for supplying those factories to the best advantage. As to the supply to the industries of the district, it was proposed to do this in one of two ways. In regard to that district where the company now had power of supply, they would give a direct supply to consumers. In the event of the authorised distributors refusing consent, they would have power of appeal to the Board of Trade. Witness was then taken in detail through the figures relating to the population, &c., of the various parts of the area, and handed in to the Committee a number of tables showing these figures, and also figures relating to the generating plants, &c., of the local authorities whose areas of supply are included in the Bill.

WITNESS having been cross-examined, the Committee adjourned.

THURSDAY, MAY 17TH.

On Thursday, May 17th, a number of manufacturers were called in support of the scheme, the general line of the evidence being that a power scheme would be of great advantage to the district.

At the conclusion of the evidence, the Chairman of the Committee raised the question of finance.

Mr. WEDDERBURN said that he would give an undertaking that unless the promoters had raised the capital by another £10,000 (the present capital raised being £10,000) before the Bill came before the other House, they would not proceed with the Bill. There had been no need to raise more than £10,000.

The CHAIRMAN: We want to be sure that if the Bill passes both Houses it will be proceeded with and not sold to someone else.

Mr. WEDDERBURN said that he would undertake that the Bill should not be sold. He would further undertake that the powers should not be exercised unless £300,000 be raised to the satisfaction of the B. of T., or at least secured, within a certain time. He would suggest 18 months as a reasonable time.

FRIDAY, MAY 18TH.

On Friday, May 18th, it was announced that Birmingham and Wolverhampton had withdrawn their opposition, and the two places were struck out of the Bill. The promoters had arranged, however, that they were to have power to lay their mains through the two districts in order to reach other parts of the area, and the Corporations of the two towns were to have the right to call upon the promoters to give them a bulk supply if they required it.

The room was cleared, and the Committee deliberated in private. On the re-admission of parties, the CHAIRMAN said that the Committee had come to the conclusion that the preamble of the Bill was proved, but a clause must be inserted to the effect that the powers given were not to be exercised unless £300,000 of the capital were subscribed within 18 months.

London Outer Circle Railway.

(*Continued from page* 822.)

WEDNESDAY, MAY 16TH.

SIR J. DOUGHTY'S Select Committee of the House of Commons considering the above Bill, sat on Wednesday, May 16th.

Sir JOHN WOLFE BARRY, engineer for the scheme, said he had served as a member of the Royal Commission on London Traffic. The estimate for the total length of the line was £2,038,000 for

works, and £1,282,000 for land, and this worked out at £80,000 a mile without equipment. He believed that the chief opponent of the scheme was the Great Eastern Railway, who had a sort of monopoly of the East-end of London, only mollified by the existence of the Tilbury Railway, and they did not wish to see another line come into the eastern parts of London. This line, however, would not interfere with the Great Eastern traffic going to the docks, and he thought they would be able to give the Great Eastern Railway help by giving them junctions towards the West, and also a very convenient junction with the Tilbury Railway. The great passenger traffic through London had always seemed to be east and west, and this would be an east and west line, with an outer circle similar to the other circles of London that had been authorised from time to time.

Mr. FITZGERALD: Is the financial position of the promoters a guarantee that the capital will be raised if the Bill is passed?—I do not give an opinion on that point. The names speak for themselves, but I think they are very convincing names. What I think is obvious is this, that if the line can be made at this cost through this district with a rapidly increasing population, and with the known exigencies of its use for goods traffic, I think it ought to be remunerative, and I see no reason whatever why it should not be remunerative. One is accustomed in London to discuss railways passing through London at a cost of £700,000 a mile. These tube railways are costing £700,000 a mile. I suppose the North London Railway would now stand at about £300,000 or £400,000 a mile, using round figures; so that, if a line of this kind, with a population increasing at the rate of 45 per cent., can be made for £80,000 or even £100,000 a mile, I have very little doubt that it will be remunerative.

The CHAIRMAN: You see no reason why the line should not be made from the estimates?—I see no reason why it should not be made.

By Mr. BALFOUR BROWNE: He believed there would be sufficient traffic to make the expenditure on the line remunerative.

The further cross-examination of the witness was postponed.

Mr. J. S. CONACHER, late manager of the North British Railway, stated that he had carefully examined the scheme, and had come to the conclusion that the route was a good one.

In answer to Mr. MOON, WITNESS said he was now connected with the Metropolitan Electric Supply Co., and had had no actual railway experience for seven years.

WITNESS was questioned at considerable length by the Chairman, and said he felt sure the line could be made for about the sum estimated, which would be about £130,000 a mile for making and equipping the line, which would run through the open country to a great extent. He would certainly attach the greatest importance to there being junctions with the other lines. The Great Western and the South Western and Great Northern Railways would get special advantages. It followed that the Great Eastern Railway would be hurt by some of their traffic being taken away, inasmuch as they had the monopoly now.

The CHAIRMAN: Really it seems to me you come back to the position that your revenue has to come very largely from the development of all this land in the outer circle of London?—Yes, to a considerable extent.

Mr. HILL, President of the Institute of British Clay Workers, and President of the Peterborough and District Manufacturers' Association, also gave evidence in favour of the scheme.

FRIDAY, MAY 18TH.

Mr. OLIVER BURY, general manager of the Great Northern Railway, who attended on a Speaker's Order, informed the Committee that his company had an agreement with the Great Eastern Railway Co., entered into in 1874, by which the Great Northern undertook not to promote or to support any Bill which would interfere with the arrangements between the two companies. For this reason he did not wish to say anything about the scheme.

The Hon. J. D. FITZGERALD, in putting questions to the witness, referred to the facilities for getting traffic from King's Cross to the docks, and witness said that that was the point on which he preferred to say nothing. It was the point with which the agreement dealt.

The CHAIRMAN asked witness if his company would have supported the Bill had they had no agreement with the Great Eastern.

Mr. BURY said that he thought they would.

Mr. BRERETON, partner with Sir John Wolfe Barry, was then called, and stated in his evidence that the total cost of the works was estimated at £2,038,000, while the land required would cost an additional £1,281,000—a total of £3,320,000. These estimates were based on prices for similar work, and were, in his opinion, sufficient for the purpose. There were no special engineering difficulties in connection with the construction. Taking this scheme generally, the route followed was the same as that authorised by the London Outer Circle Act of 1882. With regard to the petition of the London and North-Western Railway, witness said that it was not proposed to acquire any land where the line went over the line belonging to that company; all that would be required would be the usual easements. The railway would be laid out so as not to interfere with the express traffic, and the works would be of the usual character. There were no difficulties in the case of the proposed junction with the Great Eastern.

Mr. READER HARRIS, K.C. (for the owner of the Bowes Park estate) suggested to witness that the line took a roundabout route. Mr. Brereton did not agree. The line could not usefully be diverted.

By Mr. MOON, K.C., for the Midland and other railway companies: The promoters would be prepared to give the full 14 ft. 3 in. headway where the lines crossed the lines of the other companies. Mr. Moon directed several questions to witness in regard to the distances apart of the stations on the proposed line and the stations on the lines which were crossed by it. In several cases there were no stations where the lines crossed.

Sir DOUGLAS FOX was also called in support of the scheme, and gave evidence as to the junctions proposed to be made with the various other railway systems. In cross-examination, he said that no doubt for the railway to be worked to its full advantage there ought to be arrangements with the companies, more especially in regard to passenger traffic. In his opinion the line would be an element in the development of London, and have a great effect upon the housing question.

The Committee adjourned.

London County Council (Electric Supply) Bill.

TUESDAY, MAY 15TH.

(*Continued from page* 823.)

MR. J. F. C. SNELL, M.I.E.E., &c., was next called, and stated that he had had considerable experience of electrical undertakings. For the last five years he had been chief electrical tramways engineer to the Corporation of Sunderland, and in that capacity had designed and constructed the whole of the Corporation's tramway system, and their high-tension electricity distribution and power supply. The Sunderland system was practically of the same nature as the proposals of the London County Council, and there had been a very distinct growth of the undertaking, all of which had been due to the demand for power in that area. Dealing with the suggestion that it would be difficult to give a supply to authorised distributors of different frequencies, Mr. Snell said that he knew exactly what was alluded to. He maintained, however, that there was no difficulty in transforming the current the Council proposed to supply to any other current, either direct, single-phase, two or three-phase, and any number of frequencies that the authorised distributors might require. An exactly similar problem had been solved by the Chicago Edison Co., and, as a matter of fact, the Niagara Falls Power Co., with two-phase 25 cycles were supplying from that system three, two, and one-phase 25 cycles; two and one-phase 60 cycles; and one-phase 125 cycles, in addition to direct current. There was no engineering difficulty on that point, or at any rate no insuperable difficulty.

WEDNESDAY, MAY 16TH.

Mr. H. E. HAWARD, the controller to the Council, was then called. Dealing with the reports of the Finance Committee of the Council on the scheme, witness said that they were not based upon the full information in regard to the scheme as it appeared in the Bill now under consideration. The total expenditure of £2,500,000 was less than had been anticipated by the Committee when the matter was first of all considered by them. Spread over a period of from five to seven years, that expenditure would not add materially to the Council's commitments. The Finance Committee and the Council both regarded with dissatisfaction the continuous application by local authorities for loans for the extension of their electric undertakings. During the past 10 years the Council had raised loans amounting to £33,000,000, the average price being £3 3s. 6d.; the last was at £3 8s. He considered that 3¼ per cent. was a fair estimate; it was below the rate at which the companies could raise money.

The Chairman of the Committee (Mr. LUKE WHITE) interposed at this point in the proceedings, and stated that a communication had been received from the Treasury in regard to the proposal to pay £105,000 out of capital during construction. The communication pointed out that that proposal was without precedent, that the practice was condemned by the Select Committee on Loans of 1902, and that it should not be allowed in the present case without special grounds being shown.

Mr. HAWARD said that there were several precedents in the year 1902. He did not know whether they were since the passing of the report referred to, as he did not know the date of the report.

Replying to Mr. BALFOUR BROWNE'S cross-examination, WITNESS said that it was true that there were a number of electric power companies who had not yet raised a penny of capital, but he could not see any analogy between them and the L.C.C. The best answer, he thought, was that there were several companies anxious to supply London.

By the Hon. J. D. FITZGERALD, K.C. (for the Administrative Co.): He did not agree with the view that the continuous expenditure of the Council had affected its credit, notwithstanding the fact that the 3 per cent. stock now stood at 91, whereas it was 97 last year.

The clause giving the power of appeal to the B. of T. was then considered, and Mr. Henry Norman, a member of the Committee, observed that the existence of the clause would inevitably give the Council a certain demand.

THURSDAY, MAY 17TH.

Mr. JOHN HALL, the Chairman of the Electricity Committee of the Bethnal Green Borough Council, was called in support of the Bill. He said that in 1899 his Council obtained a provisional lighting order. A site had been purchased, and a scheme costing between £40,000 and £50,000 prepared. As it appeared that the scheme would not be a financial success the matter was allowed to drop. Offers were then received from the Charing Cross, West End and City Electricity Supply Co., which had bulk supply powers in Bethnal Green. The Council also received offers from the Shoreditch, Hackney and Stepney Borough Council for a supply in bulk. After these offers had been received his Council heard of the proposals of the L.C.C., and now felt that the L.C.C. should have the

right to supply in bulk, and would prefer to take a supply from that authority.

Mr. J. Marlow Reed, Chairman of the Finance Committee of the Wood Green U.D.C., was also called, and said that in 1903 the North Metropolitan Electric Power Supply Co. offered his Council a supply of current at 2·5d. per unit; the offer was declined. Afterwards they applied to the Local Government Board for a loan for the purposes of a municipal undertaking, but were refused this. The existence of the L.C.C. scheme would, if it were carried out, enable them to get a cheap supply.

Cross-examined by Mr. Tyldesley Jones, Witness said that negotiations were being carried on with the Hornsey Borough Council for an amalgamation in that district, and a supply was possible from there.

Mr. John Bodger, chairman of the Ilford U.D.C., said that that authority would prefer to take a bulk supply on terms, rather than extend their own works.

This concluded the case for the L.C.C.

Prof. Thorpe, from the First Commissioner of Works, and several other expert witnesses attended at the instance of the Committee, and spoke as to the possible effect of the generation stations at Greenwich and Battersea on the vegetation in the Parks, &c., of the metropolis. He said that coal contained about 1 per cent. of sulphur, and in burning gave twice the weight of sulphurous acid. This when emitted into the air would be borne down by a heavy rainfall, and converted into sulphuric acid would injuriously affect the stonework of buildings as well as vegetation. The consumer of coal had it within his power to minimise the amount of sulphurous acid, as he could burn coal of high calorific value and treat it with milk of lime, which would considerably minimise the amount of acid produced. He suggested that a clause to that effect might be inserted in the Bill. He did not agree with the view that lime water added to the coal produced clinkers to any great extent.

Mr. Edward J. Rivers, chief engineer to the Office of Works, also gave evidence.

The case for the L.C.C. having been concluded, the hearing of the opposition was commenced, that of the Willesden U.D.C. being taken first. Mr. Tyldesley Jones, who addressed the Committee on behalf of that authority, contended that Willesden should be exempted from the area of the Bill.

The Chairman asked if learned counsel would show how the L.C.C. could supply Willesden without first obtaining consent.

Mr. Jones said that such competition would be possible under Secs. 2 and 3 of Clause 11 of the Bill.

On this the Chairman observed that the Committee would protect the Willesden Council against any competition, and, if necessary, the clause would be amended later on.

Continuing his speech, Mr. Tyldesley Jones dealt with the question of the possible unfair competition which he alleged would exist between the L.C.C. and the North Metropolitan Power Co., the company which now supplied Willesden. It might, he said, have a serious effect upon the stability of the company and might ultimately leave the Willesden Council entirely at the mercy of the L.C.C. If that were so, Willesden could not be supplied at the lowest price, owing to the fact that it was 8 miles from Battersea.

Evidence in support of these statements having been called, the Committee adjourned.

North-West London Railway Bill.

(*Continued from page* 821.)

Sir Douglas Fox, joint engineer with Sir Benjamin Baker for the scheme, was called on Tuesday, May 16th, and said that with the extension to Victoria, the line would make the most important north and south connection which could be proposed for London. Referring to the frontagers' petitions, Sir Douglas said that he should place the tubes as near as possible to the eastern side of Grosvenor Place and Gardens. If that were done, there would, he thought, be no injurious effect upon the frontagers' property. As to protection against damage, he considered that the clause framed by Lord Windsor's Committee was ample and met all interests. The proposal to have a junction with the Hammersmith, City and North-East London line would be objectionable, as it would greatly interfere with the running of a two or three-minute service. In fact, it would be impracticable to run such a service at all if the junction were made.

Mr. Moon, K.C., interposed here, and asked the Committee not to impose on the promoters the condition that the line should not be proceeded with until agreements had been come to with all the railway companies concerned.

The Chairman intimated that the Committee would carefully consider the matter.

On Wednesday, May 17th, Sir Benjamin Baker was called, and stated that in his opinion it would be detrimental to the future of tube railways in London, if any attempt to make the tubes larger in size were successful. It would be a mistake in the interests of the public.

Col. Yorke, Chief Inspecting Officer of Railways under the B. of T., then gave evidence, at the request of the committee, to the effect that the B. of T. were substantially satisfied with the present regulations concerning the public safety in tube lines.

Mr. Stephen Sellon, consulting engineer to the Metropolitan Tramways Co., was then called and dealt at some length with the probable number of passengers which the proposed line would carry. Basing his figures on the omnibus traffic he put the number of passengers at 36,000,000 a year. At 2d. fares over the whole of the route the gross receipts would be £300,000. Working expenses would be some 50 per cent. of that. In cross-examination witness admitted that he had estimated a traffic of 35,000,000 passengers on the Baker Street and Waterloo line, and when the extensions to Paddington and to the Elephant and Castle were completed, he believed that his estimated number would be found to be correct.

Prof. Thorpe, who attended at the suggestion of the First Commissioner of Works, stated that that department had proposed that a model clause should be inserted in all Bills under which powers were sought for the erection of generating stations.

Mr. Moon, K.C., said that as the clause would probably be made universally applicable, the promoters would insert in the Bill whatever clause was agreed upon.

Wireless Telegraphy Bill.

On 18th inst. the House of Lords when in Committee on this Bill passed an amendment moved by the Earl of Granard, limiting the continuation of the Act of 1904 to three years instead of six.

According to the *Times* report, Lord Avebury said the Committee of Lloyd's had requested him to move the rejection of the Bill, or its reference to a Select Committee, in consequence of the manner in which the Government monopoly was being exercised; it was alleged that the claims of the shipping and mercantile community were ignored. There were three main companies engaged in wireless telegraphy, and two of them had written to him to the same effect.

The Earl of Granard said that the object of this Bill was to continue in force the powers of the Act of 1904 for six years, but in consequence of the representations of the Marquis of Londonderry the period of extension would be reduced in Committee to three years.

The Marquis of Londonderry said they realised that when this extraordinary invention became better known it would not be right to check enterprise, but it was necessary to have some hold over it, in order that companies that might be formed in the future should not establish installations too close to each other and thus damage themselves and also the public interest. It was necessary that the licences should be constantly reviewed, and, therefore, the period of extension should be limited.

The Earl of Granard moved to substitute "1909" for "1912."

The amendment was agreed to.

Telephone Communication in the West of England.—In the Parliamentary Papers for 17th inst., Mr. E. Dunn asked the Postmaster-General if he is aware of the delays that are constantly occurring in trunk telephone calls from London to Exeter, Plymouth, and other places in the West of England; that, quite apart from special delays, it often takes two or more hours to get calls through; that the reason given by the authorities is the absence of a direct line beyond Bristol; and whether prompt steps will be taken to provide a direct line or in some other way to put an end to the existing state of affairs. Mr. Sydney Buxton states in reply that a trunk telephone circuit between London and Exeter is in course of construction, in order to provide a more direct means of communication between London and the Devonshire and Cornish towns than at present exists. The delay is, however, not so much due to the want of this direct line, as to the non-completion, owing to the difficulties of obtaining wayleaves, of a trunk circuit between London and Bristol, which was commenced two years ago. The work is now, however, being pushed on. The delay does not, as a rule, exceed an hour, and, pending the completion of the new circuits, every endeavour is being made to give as good a service as possible.

Post Office Engineering Stores and the Claim of Ireland.—In last Friday's Parliamentary Papers, Mr. Field asked the Postmaster-General what was the amount spent annually in the purchase of Post Office engineering stores, and how much of it was spent in Ireland, and whether he contemplated giving contractors the same opportunities of tendering for the delivery of the Irish supplies as were now afforded in the case of uniforms, &c., required for the Post Office service in Ireland. Mr. Sydney Buxton stated, in reply, that the amount spent last year on the purchase of Post Office engineering stores was £953,000, of which about £500 was spent in Ireland. The value of engineering stores used in Great Britain and Ireland was £952,000 and £11,500 respectively. Any makers of such stores in Ireland who desired to be invited to tender should send their names and all other necessary particulars to the Controller of Stores, Bedford Street, W.C.

Great Northern Railway Bill.—On Thursday, May 17th this Bill, which was unopposed, came before the Chairman of Ways and Means, and was ordered to proceed. Amongst a number of other things power is taken to provide £50,000 of the capital required to construct a generating station for the Great Northern and City Railway.

Metropolitan Railway Bill.—Mr. Emmott's Committee of the House of Commons, on Thursday, May 17th, ordered the above Bill to go for third reading. The Bill provides for the enlargement and improvement of Baker Street Station, &c.

Baker Street and Waterloo Railway Bill.—This Bill came on Thursday, May 17th, before Mr. Emmott's Committee of the House of Commons as an unopposed Bill, and was ordered to go forward for third reading. The Bill provides for a station at Paddington with subways.

Oldham and Saddleworth Tramways Bill.—The Standing Orders Committee of the House of Commons has decided to dispense with Standing Orders in the case of this Bill, and allow the parties to proceed.

Second and Third Readings.—In the House of Commons on 21st inst. the Ascot District Gas (Electric Lighting) Bill and the Brixham Gas (Electric Lighting) Bill were read a third time. The London United Tramways Co. Bill was considered and ordered for third reading. The Buenos Ayres Grand National Tramways Bill, the Oldham and Saddleworth District Tramways (Abandonment) Bill, the Wallasey Tramways and Improvements Bill, and the Hackney Electricity Bill, all passed second reading on the same day.

Electric Lighting Corporation Orders Bill (No. 5).—On Monday the Examiners of Standing Orders found that the necessary formalities had been complied with in the case of the above Bill, and ordered it to go for second reading. The Bill confirms orders granted by the Board of Trade to the following:—To Messrs. Christy Bros. & Middleton, in respect of Bude; to the Camberley Electric Supply Co., in regard to Camberley and district; to the North Metropolitan Electrical Power Distribution Co., in regard to the districts of East Barnet Valley and Wealdstone; to the Exeter Corporation for an extension of its existing order; to the Frome Urban District Council for an amendment of the existing Act; to the Northampton Electric Power and Traction Co., in respect of Higham Ferrers, Rushden and Wellingborough Rural District; to the County of Durham Electric Power Distribution Co., in respect of Mid-Durham; to the Corporation of Wisbech, in respect of an amendment of their existing order; and to the Rural District Council of Yardley, also in regard to an amendment of their existing order.

Derbyshire and Nottinghamshire Electric Power Bill.—This Bill, which regulates the capital of the company, and gives power to raise additional capital, was on Thursday last week before the Chairman of Ways and Means of the House of Commons as an unopposed measure, and was sent forward to the House for third reading.

Lancashire Electric Power Bill.—The Great Central Railway, the Lancashire and Yorkshire Railway, the Manchester Corporation, the Darwen Corporation, and seven District Councils have withdrawn their opposition to the above Bill.

Electric Lighting Confirmation Order (No. 3).—This Bill came before the Examiner of Standing Orders on Monday, and was ordered to go for second reading. It confirms the provisional orders granted by the Board of Trade to the County Council of Lanark in respect of the lighting districts of Bellshill, Blantyre, Bothwell, Shettleston and Tollcross, and Uddingston; and orders granted to the Provost and Magistrates of Dunfermline and District and Dunoon; to the Duke of Richmond and Lennox in respect of Fochabers; and to the National Electric Construction Co., Ltd., in respect of Inveresk.

Metropolitan District Railway Bill.—Sir Geo. Doughty's Committee of the House of Commons, in their report to the House on the Metropolitan District Railway Bill, states that the Board of Trade did not offer any observations upon the clause in the Bill authorising the company to supply electrical energy to the London County Council, but it appeared that the promoters had struck the powers out of the Bill. Part IV of the Bill, dealing with the surplus lands of the company, had also been struck out by the promoters.

Injudicious and Amazing Advocacy.—Granted the high thermal efficiency of the internal combustion engine, a figure about twice that of the best steam engines, there is no need to spoil a good case by putting forward ill-founded figures and comparing dissimilar sources of power from dissimilar standpoints; yet Mr. E. R. Knowles, in an article entitled "The Coming Power," published in our American contemporary and namesake, spoils a good case by stringing ill-founded figures together, and adding these to a merely passable extract of manufacturers' catalogues, and of earlier and more competent extracts of original tests of the thermal efficiency of various heat engines.

Mr. Knowles writes as though a saving in the cost of fuel were the only factor of commercial concern. A sense of perspective would be a valuable acquisition to him, and would assist in his appreciation of the fact that prime cost, attendance and wear and tear all contribute to working costs.

The worst feature in an article which is lacking in utility to those with any engineering experience lies in a table entitled "Comparative Costs per Brake-horse-power per Year." To begin with, the arithmetic is disgraceful. While the first line, dealing with producer gas, is correct for a year of 300 days of 24 hours per day, the second line, dealing with natural gas, is only correct if the year shrinks to 150 days of 24 hours each; or, if remaining at 300 working days, these have become shortened to 12 hours each. Again, if the cost for crude oil at 4 cents per gallon is $·004 per B.H.P.-hour, and for gasoline at 12 cents per gallon is $·012 per B.H.P.-hour, why should the cost per B.H.P.-year be $16·00 for crude oil and $40·00 for gasoline? This would involve a year of 166 24-hour days in the one case, and a year of 139 similar days in the other case. Even more startling is the arithmetic of the Corliss condensing engine and of a steam turbine. Here we are given $·0045 as the fuel cost per B.H.P.-hour and $43·50 per B.H.P.-year. Here the year rises unaccountably to 402 days and some odd hours. The climax comes in the case of electric power. Why the fuel cost should be $·0225 per B.H.P.-hour when a dynamo is coupled to an engine or turbine, the fuel costs of which are previously computed at one-fifth of this amount per B.H.P.-hour, passes our comprehension. The year in this case pans out at 132 days of 24 hours each.

Surely such a farrago of muddled arithmetic never before appeared in a journal supposed to be devoted to electrical engineering. Even though this table is embroidered with copybook and catalogue sentences, the whole forms unmitigated slush.

PROCEEDINGS OF INSTITUTIONS.

A New Single-phase Commutator Motor.

By V. A. Fynn, M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *March 8th*, 1906.)

(*Concluded from page* 819.)

In the continuous-current machine we obtain sparkless commutation whenever it is possible to balance the reactance voltage by a voltage induced in the short-circuited coil by some external means, or simply by the voltage resulting from the unequal distribution of the current under the brush. In the continuous-current machine there is only the reactance voltage to provide for; this may vary in magnitude, but its phase is constant. In the motor under consideration we have to deal with three distinct E.M.F.'s of different phase and varying magnitude. The resultant of these three is the one to be balanced, and this varies in phase as well as in magnitude. This fact makes it particularly difficult to balance it by inducing in the commutated coil a suitable E.M.F. by some external means, since that E.M.F., in order to be effective, would have to follow the variations of the resultant not only in magnitude, but also in phase. At any rate, for small machines one must fall back on commutation by means of unequal distribution of current under the brush, which at once presents limits to the designer.

At starting, only the first two E.M.F.'s above mentioned need be considered, and, as a rule, the second will be the greatest. As the motor speeds up, the third comes into play; being of opposite phase to the second, its effect is to diminish the latter. When synchronism is reached, these two practically cancel out, and there only remains the first, or the reactance E.M.F., to balance.

Taking advantage of these conditions, and with careful design of the rotor, it has been possible so far to dispense with the slip-rings altogether up to sizes corresponding to about 50 H.P. at some 400 revolutions; such smaller machines are made on the lines of fig. 11, but with only one winding on the rotor, and without slip-rings. In

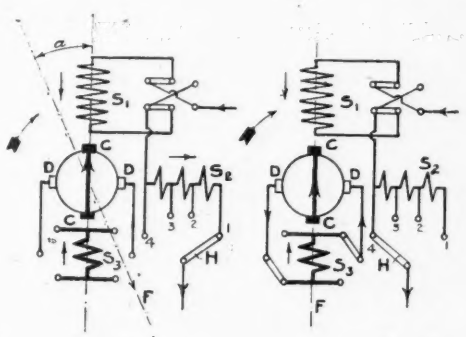


Fig. 13. Fig. 14.

motors of greater power intended for continuous running at full load, provision is made for short-circuiting a number of points on the rotor winding, so as to relieve the commutator and to be able to make a smaller one do.

The complete diagram of connections of a motor for intermittent load, and designed to run in both directions (for instance, for elevator service), is given in figs. 13 and 14; in this case it will be noticed that the resistances in the field circuit are suppressed. In order to reverse the direction of rotation, it is preferable to reverse the current through the winding s_1. Rotation would also be reversed if the current through s_2 were reversed; but as the tappings must be unequally spaced in the latter, such a course would lead to complications in order to restore the proper stepping.

The average results which can be obtained with such motors vary somewhat with the periodicity of the supply and the number of poles of the motor. Taking as a basis 50 periods, and what can be considered as a normal number of poles, and further assuming that the voltage at the terminals is not raised at starting above the value for which the motor is designed, a maximum torque, two to two and a half times the normal, can be secured with about one and a half times the normal current. The motors will start light with about no-load current, or not more than one-fourth of the normal current.

The power-factor can always be brought up to unity; this, however, may entail a heavier current in the rotor and slightly higher losses. On that account the smaller motors are not, as a rule, fully compensated, as it does not appear advisable to lower the efficiency for the sake of improving the power-factor by some 5 per cent. Thus for small machines up to 6 or 7 H.P. the power-factor is only raised to 0·7 or 0·8 at no-load, reaching 0·9 to 0·94 under load. The power-factor curve rises very rapidly at first, and as the load increases it remains nearly constant.

The larger machines are designed for a power-factor seldom falling below 0·9 and reaching 1; these can be made to take a leading current when desired.

The efficiency of these compensated motors closely approximates to that of good asynchronous machines with squirrel-cage rotors.

In the smaller sizes it falls some 2 to 3 per cent. below the latter. In the larger sizes the efficiency quite equals, and sometimes, for a large number of poles and high frequencies, materially exceeds that of the corresponding asynchronous motor.

Altering an ordinary asynchronous single-phase motor to the construction which we have described will increase its output from 30 to 40 per cent., besides vastly improving its power-factor; but the increased output and the better power-factor of these machines do not entirely compensate for the increased losses.

The behaviour of these compensated machines under normal running conditions is interesting, and differs in many respects from that of the ordinary asynchronous induction motor.

Thus, for instance, at no load the speed is, as a rule, a little above the synchronous. At full load the drop in speed reaches about 10 per cent. in the smaller sizes, where no means of short-circuiting a number of points of the rotor winding, independently of the commutator, are provided. In the larger sizes, where independent short-circuiting devices are employed, the slip approximates more nearly to that of the ordinary asynchronous motor. When heavily overloaded, the speed may drop to about two-thirds of the synchronous before the motor will pull up. This great drop acts as a safety-valve to some extent, and prevents the motor from falling out of step under momentary heavy over-loads.

The starting gear for the smaller machines simply consists of a 3-pole 2-throw switch. As a rule s_2, the stator series field winding, is provided with two tappings besides the beginning and end: these are taken to four terminals; the end is joined directly to the beginning or end of the s_1 winding, according to the direction of rotation required. In the starting position the switch is connected to one of the three free terminals of the series field winding s_2, the choice depending on the torque required. In the working position the s_2 winding is entirely cut out, and the shunt circuit closed on the s_3 winding. It is, of course, best to throw the switch over into the working position at the time when the motor has reached its normal speed, but no damage or undue rush of current will result if the exact moment has not been correctly estimated. If the motor starts light, the switch can be thrown over as soon as the motor has made a few revolutions; if left in the starting position the speed will rise to, perhaps, 20 or 30 per cent. above the synchronous, but will at once fall to the normal on the switch being brought into the working position—there will be a momentary rise in the current not exceeding 25 per cent. If the motor starts under load the switch can be thrown over at any time after the motor has reached, say, a third of its normal speed. This margin is certainly sufficient, even when the motor is operated by unskilled men. If the motor does not start at all in the first position, it is useless to throw the switch over, as this will only cause a short-circuit.

Larger motors are provided with controllers connected according to figs. 13 to 14. The current is switched on gradually, and the motor starts according to the torque required on the first, second, or third point. With such a controller it is possible to regulate the speed of the motor to a great extent. If the s_3 winding is only in circuit on the last point, then on all the others the motor will have a series characteristic. If this winding is kept in circuit, then the speed, even at no-load, can be greatly reduced by moving the controller back; that reduced speed will, however, not be maintained nearly constant under load, but will fall off much in the same way as the speed of a shunt motor with weakened field. This drop will be the greater the more of the s_2 winding is switched into circuit. Under these conditions the power-factor and efficiency fall off to about two-thirds of their normal value.

A number of curves are appended which have been obtained by actual tests on some of the smaller motors built.

The motor No. 1 was built into the frame of a standard 50-cycle four-pole machine, which, as an asynchronous squirrel-cage single-phase motor, gives $\frac{3}{4}$ B.H.P. continuously, at some 1,460 revolutions. It was fitted with an experimental continuous current armature, and tested both as a plain shunt induction motor, with a rotor short-circuited along two axes stationary in space and displaced by $\frac{180}{n}$ degrees (see fig. 1), and as such an induction motor, with the addition of the improvements described in this paper. (See fig. 14.)

The armature was not of the most suitable design, but as the same one was used in both cases, the comparison is fair, and clearly shows the enormous advantage of the compensation. The curves relating to the first test are shown in fig. 15; those relating to the second, in fig. 16 (p. 863). It can be seen that the addition of the author's compensating winding caused the no-load current to fall from 8·8 to 3·7 amperes and the power-factor to rise from 0·38 to 0·78, while the maximum efficiency rose from 32·8 per cent. to 49·5 per cent. Whereas without compensation the output at maximum efficiency was 0·7 B.H.P., with compensation it reached 1·25 B.H.P. In the first case the speed dropped to 1,235; in the second, and notwithstanding the greater output, to only 1,285; the respective power-factors being 0·665 and 0·935. With a more satisfactory armature, the compensated motor gives a continuous output of 1·25 B.H.P., and shows a smaller drop in speed. The efficiency in this case is about 3 per cent. less than that of the corresponding squirrel-cage motor.

In most of the curve sheets included in this paper it has been found conducive to greater clearness sometimes to place the zero of some of the vertical scales on different levels. Attention is drawn to this in order to avoid possible misunderstandings.

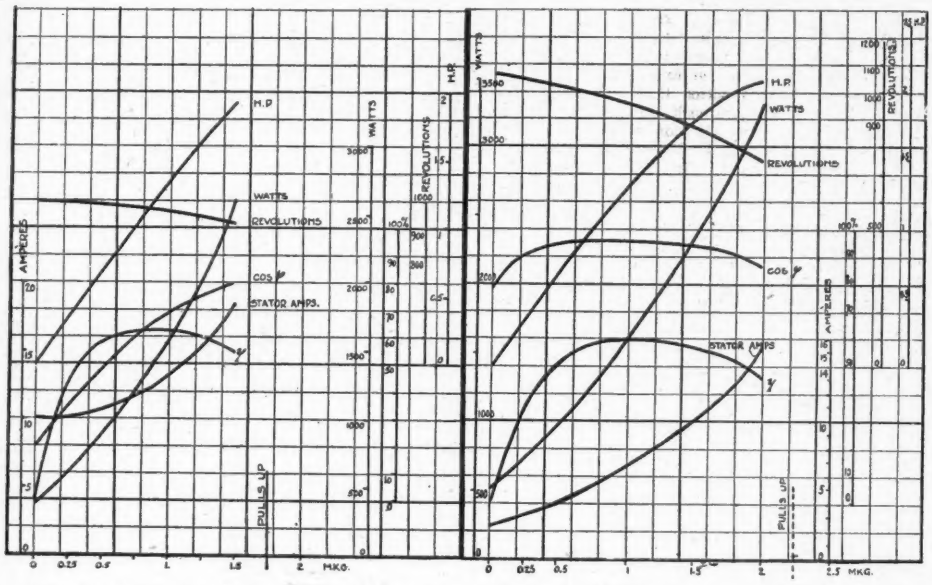


Fig. 17.—Motor No. 2; 175 Volts, 50 Cycles.

Fig. 18.—Motor No. 2; 250 Volts, 50 Cycles.

A comparison between an asynchronous induction motor with squirrel cage and a motor of this new type is afforded by figs. 17 and 18. The same frame, No. 2, has been used in both cases; it is that of a standard single-phase motor giving continuously 1·5 B.H.P. at 50 cycles and about 1,460 revolutions when wound for four poles. This machine had never been built with six poles, on account of the bad performance expected at the lower speed.

As an experiment it was wound for six poles, and the result of the tests is shown by the curves in fig. 17. The machine in this form is of no practical value, as can be gathered from these curves, and it gets too hot. The densities would have to be much reduced to keep within the limits of temperature rise, and to reduce the no-load current as far as possible. With six poles an output of about 0·95 B.H.P. could be obtained, with a no-load current of not less than 70 per cent. of the full-load value.

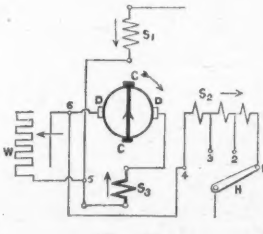


Fig. 22.

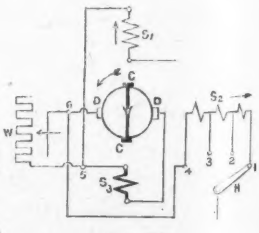


Fig. 23.

Preliminary tests showed that sufficiently good results would be obtained with the addition of the author's improvements. This stator was re-wound for 250 volts (to suit a certain supply circuit), the densities being lowered by 4 per cent. The result was a good commercial machine, and is illustrated by the curves in fig. 18. In this form 1·3 B.H.P. can be obtained continuously from that frame when wound for six poles. Comparing the two sheets of curves, and reducing the stator current of the first to 250 volts, we find that at no-load the speed has risen from 950 to 1,060, the power-factor from 0·2 to 0·78, whereas the current has fallen from 7 to 2·5 amperes. At full load the speed is now 950 instead of 960, the power factor 0·952 instead of 0·68, the current 6·8 instead of 9 amperes, the efficiency 59·5 per cent. instead of 62·5 per cent., whereas

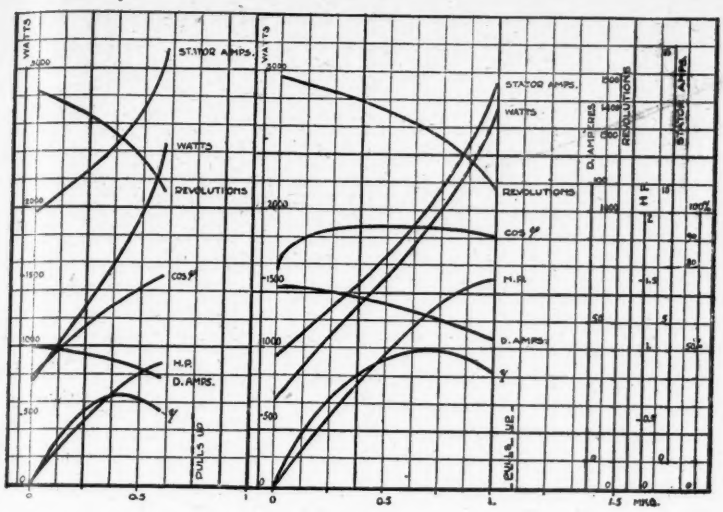


FIG. 15. MOTOR NO. 1. FIG. 16.
220 VOLTS, 50 CYCLES.

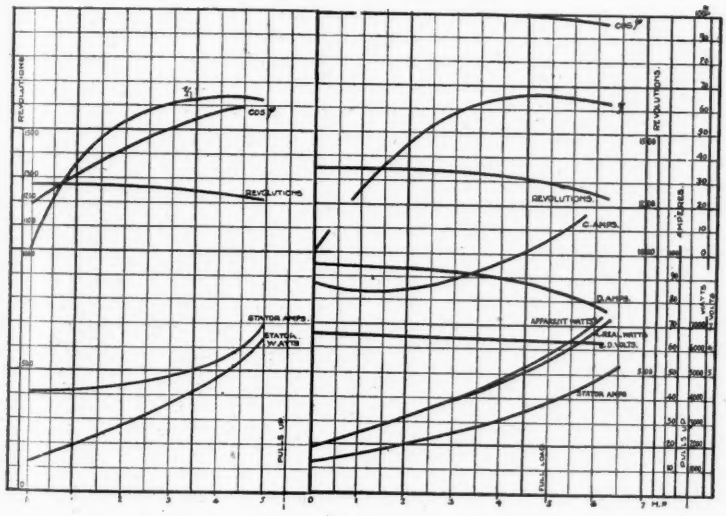


FIG. 19. MOTOR NO. 3. FIG. 20.
150 VOLTS, 85 CYCLES.

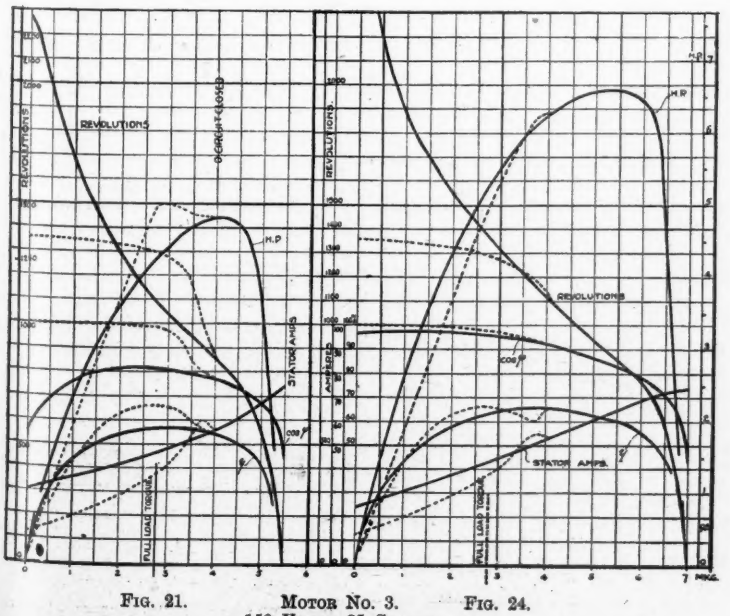


FIG. 21. MOTOR NO. 3. FIG. 24.
150 VOLTS, 85 CYCLES.

the maximum torque which the motor can exert before pulling up has risen from 1·75 to 2·25 mkg. The maximum output, which, of course, takes the speed into consideration, has only increased by some 8 per cent. This improved motor, which is one of a standard series, easily starts with a pull of 2·5 mkg., that is, 2·5 times the normal, while there is no sparking at the commutator either at starting or under normal running conditions.

Motor No. 3 shows another case where an ordinary squirrel-cage single-phase motor absolutely fails, whereas the new compensated motor gives excellent results. Frame and winding are identical in both cases. The results with the squirrel cage are shown in fig. 19, those with the new motor connected as in fig. 14 are illustrated in fig. 20. The frame used is that of a standard single-phase four-pole motor generally wound for four poles 50 cycles, and giving under these conditions 6 B.H.P. continuously. This frame was now wound for 8 poles and 85 cycles; the test with the squirrel cage showed that the machine was practically useless, whereas the results obtained with the new arrangement are quite good. This particular machine was designed for intermittent load. A comparison of the main data shows the following results at no-load; the speed of the squirrel cage was 1,270 as against 1,355, the no-load current 41 as against 12·8 amperes, the power-factor 0·19 as against unity. The maximum B.H.P. available was 5·5 and 8 respectively, so that the squirrel cage could not be worked normally at the required normal load of 5 H.P. The maximum efficiency is better by 2 per cent. for the compensated motor, reaching 66 per cent. at full load.

The curves, fig. 20, also show the variation in the rotor currents in the C and D axes, as well as the value of the auxiliary E.M.F. (D volts) impressed on the D circuit. It had already been said that the overload capacity of these motors depended greatly on the value of this E.M.F.: in this case the experiment was tried. With 10·38 auxiliary volts on the D brushes the power-factor was unity, the speed 1,266 revolutions, the output 7·97 B.H.P. at 63·1 per cent. efficiency, and the overload capacity 9 B.H.P. The current in the D axis rose to 110·5, that in the C axis to 174·5 amperes. It is owing to this large current in the latter axis that the efficiency was a little lowered. At lighter loads the current taken by the motor was leading. These last results have been added with the object of showing that care must be exercised in the predetermination of the auxiliary E.M.F.: if this be chosen too high the efficiency might suffer for the reasons already set forth. Particular care is required when high densities are adopted. The current in the field axis follows the same laws as an ordinary magnetising current.

In fig. 21 is shown a set of curves illustrating the starting performance of motor No. 3. The point of the starting switch to which this set of curves corresponds is one for which the proportion of ampere-turns in the s_2 and s_1 windings is as 1 to 3·5. Similar sets of curves would be obtained for other points of the starting switch.

The full-line curves illustrate in detail the performance of the motor with varying load as a series-induction motor (D circuit open). The speed for any given torque could be increased or decreased by moving the switch forward or backward. The dotted curves were obtained by gradually closing the shunt exciting circuit, beginning with a resistance of half an ohm in circuit when a speed of 860 revolutions (two-thirds of normal) had been reached, reducing this to ·15 ohm and then cutting it out altogether. It is seen that the available torque never sinks under 2·78 mkg., which corresponds to the full-load, and that the speed curve is regular enough for all purposes. The maximum torque obtainable, however, only just reaches twice the normal. The auxiliary E.M.F. employed was the normal —*i.e.*, 6·5 volts, and was practically constant.

It remains for us to deal with a modification of this motor, capable of developing without increase of pressure at the terminals, and without starting apparatus of any kind, a torque at starting at least four times the normal on circuits of 50 periods. This machine is particularly well suited to do duty where a series characteristic is required, and since it can be converted into a constant-speed machine at

any time and with the greatest ease, it is also suited for ordinary work, more particularly, however, for elevator service on high periodicity circuits, and where specially great starting efforts are needed, together with freedom from racing.

It has been shown that the rotor winding in the axis D D is made use of in the shunt-induction machine as the field winding. It is clear that if it can be used as a shunt-exciting winding it can be also used as a series-exciting winding. The author has found that, for the purpose of starting and speed regulation, a very marked improvement can be secured by connecting the rotor winding along the axis D D in series with the field winding s_2 disposed on the stator, and also in series with the transformer winding s_1. Going a step further, he also connected the winding s_3, providing the auxiliary E.M.F. for improving the power-factor when working at a constant speed, in series with the windings already enumerated. These connections are shown diagrammatically in figs. 22 and 23 for both directions of rotation.

By this change of connections the nature of the machine is not altered in any way; it is still nothing more than a series-induction motor. As before, the stator group s_1 induces the armature current, but instead of all the motor field winding being disposed on the stator, part of it is also disposed on the rotor; the rotor winding itself, in the axis D D, doing duty as such.

The winding s_3 has a small E.M.F. generated in it, which is co-phasal and of the same direction as the E.M.F. impressed on the motor, and consequently increases the total active E.M.F. The advantages secured are manifold. As before, the machine can be designed to take as little current as may be desired on the first point of the starting-switch without the help of external resistances, transformers, and the like, and with fewer turns in the group s_2 than were previously required. Whereas before, when the rotor field winding was not in series with the stator field winding, the starting torque fell to zero as soon as all the stator field winding was cut out, now the starting torque reaches a maximum at that point. This last difference is of extreme importance for heavy work, and particularly so for lift work.

The phase of the E.M.F. due to s_3 tends to coincide more and more with the motor field as the motor speed increases. The field brushes D, which before were idle during the greater part of the starting period, are now made use of from the very beginning, and with the greatest benefit. As to the conversion of the motor into a shunt induction machine, it is almost simpler than before; all that is necessary is to short-circuit gradually or suddenly, the points in the connections marked 5 and 6. If a resistance W is connected in parallel to these points, the speed can also be regulated to some extent by its help. The higher the resistance, the nearer will the characteristic of the motor approach to a series characteristic. A reduction of this resistance tends to bind the motor more and more to its natural constant speed, decreasing its speed if the same happens to be above the natural, and increasing it if it happens to be below the natural.

For the purpose of short-circuiting the points 5 and 6 at approximately the natural or synchronous speed, the author has devised a very simple centrifugal arrangement which can be fixed on the motor shaft outside the frame and which secures a quick make and break; in this way the controllers for lift work, for example, are greatly simplified. Such a short-circuiting device will operate well within 15 per cent. (up or down) of the prescribed speed, so that every shock is absolutely avoided. It is only necessary for the various windings which have been enumerated to be in series relation to each other; they need not be connected in series directly, it being possible and sometimes very useful to interpose series transformers.

As an illustration of the advantages to be gained by this improved means of starting, some tests carried out on No. 3 motor are graphically reproduced in fig. 24. The transformation ratio from stator to rotor was 2·6 to 1. Notwithstanding that no transformer was used to feed that part of the field winding which is disposed on the rotor, the connections being exactly as shown in fig. 22, the improvement secured is very marked indeed—with the same starting current a 27 per cent. greater torque was obtained; in other words, a torque 2·5 times the normal, with rather less than twice the normal current, and this with a small eight-pole motor on an 85-cycle circuit. Apart from this, the properties of the motor as a series-induction machine (full lines) are vastly improved, the maximum power-factor rising from 0·82 to 0·975, the maximum efficiency from 57 to 66 per cent., and the maximum B.H.P. from 6·56 to 7·6.

The dotted curves show what would happen if the centrifugal device referred to acted at 15 per cent. below the normal speed. In order to carry out this test the rise of speed was watched on a tachometer, and the points 5 and 6 were short-circuited at a speed of 1,100 revolutions. The transition to shunt operation is even more perfect than in the previous case.

Traction motors have been built and tested, giving excellent results. These machines have a very high power-factor and commutate well. Comparatively good efficiencies have also been secured; that of a 60-B.H.P. motor at 500 revolutions reaching 82 per cent. for 40 B.H.P. and 86 per cent at full load. The author hopes shortly to have an opportunity of publishing a more detailed account of this special work.

H.-B. Lifeguards.—MESSRS. HUDSON & BOWRING, LTD., have received orders for lifeguards for cars at Torquay, Mexborough, Swindon and Port Elizabeth, and for the Dublin locomotives. They have also received repeat orders for Derby, Croydon, Gosport and Fareham.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

10,622. "Improvements in leading-in wires for electric incandescent lamps." S. O. COWPER-COLES. May 7th.

10,630. "Improvements in controlling gear for electric cranes and like hoisting apparatus." W. DIXON. May 7th.

10,639. "Improvements in apparatus for starting up synchronous alternating current dynamo-electric machines." BRUCE PEEBLES & Co., LTD., and J. L. LA COUR. May 7th.

10,654. "Improvements in outlet or junction boxes." C. C. SIBLEY and G. A. LUTZ. May 7th. (Complete.)

10,655. "Improvements in elbows for conduits for electric wires." C. C. SIBLEY and G. A. LUTZ. May 7th. (Complete.)

10,674. "Improvements in and relating to electric trumpets and the like." B. SETTEGAST. May 7th. (Complete.)

10,684. "Improvements in and relating to dynamo-electric machines." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) May 7th.

10,702. "Improvements in supporting devices for telephone apparatus." H. SEFTON-JONES. (H. Boas, Germany.) May 7th. (Complete.)

10,703. "Improvements in adjustable suspenders for electrical devices." A. BERRY. (Date applied for under Patents Act, 1901, July 11th, 1905, being date of application in United States.) May 7th. (Complete.)

10,719. "Improvements in sparking plugs for internal combustion engines which are fired by magneto-electric machines." T. GREVES. May 8th.

10,778. "Improvements in electrical safeguard indicator apparatus for railway points, signals and the like." SIEMENS & HALSKE AKT.-GES. (Date applied for under Patents Acts, 1901, September 2nd, 1905, being date of application in Germany.) May 8th. (Complete.)

10,795. "Improvements in and relating to commutators for dynamo electric machines." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) May 8th.

10,802. "Improvements in and relating to the electrolytic deposition of metals." S. O. COWPER-COLES. May 8th.

10,812. "Improvements in or connected with dynamo-electric generators, electric motors and other electric apparatus." W. K. MELDRUM. May 9th.

10,819. "An improved terminal for making electrical connections." H. E. BEACH. May 9th.

10,826. "A beam or girder clip for supporting electrical conduits, gas or other pipes in ferro-concrete or other buildings." J. H. WINTER. May 9th.

10,861. "Improvements in electric meters." C. FERY and E. GRASSOT. May 9th. (Complete.)

10,863. "Improvements in and connected with telephones, phonographs, sound horns and the like." C. JOLY. May 9th.

10,904. "Improvements in machines for use in the manufacture of incandescent electric lamps." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) May 10th.

10,930. "A cable finder and pulley guide for use in connection with electrical traction." T. FARRAR. May 10th.

10,957. "Improvements relating to vapour electric apparatus." P. H. THOMAS. Date applied for under Patents Act, 1901, May 11th, 1905, being date of application in United States.) May 10th. (Complete.)

10,962. "Improvements in ignition apparatus for internal combustion engines." W. MILLS. May 10th.

10,976. "Improvements relating to electric conductors." H. H. LAKE. (The Parker-Clark Electric Co., United States.) May 10th. (Complete.)

10,981. "An improved protecting device for the sparking plugs of interna combustion engines." W. R. MACDONALD. May 10th.

10,993. "Improvements in connection with dynamo-electric machines." ELEKTRIZITATS ACTIEN GESELLSCHAFT VORM. W. I AHMEYER & Co. (Date applied for under Patents Act, 1901, May 11th, 1905, being date of application in Germany.) May 10th. (Complete.)

10,996. "Improvements in electric signals for railways." J. B. LINEBACK. May 10th. (Complete.)

11,028. "Improvements connected with electric tail lamps for motor-cars." G. J. JACKSON. May 11th.

11,042. "Improvements relating to electric heating apparatus." A. CLARKE. May 11th.

11,058. "Improvements in electric circuit breakers." G. G. STOUT. May 11th. (Complete)

11,081. "Improvements in connection with dynamo-electric machines." ELECTRIZITATS ACT.-GES. VORM W. LAHMEYER & Co. (Date applied for under Patents Act, 1901, May 12th, 1905, being date of application in Germany.) May 11th. (Complete.)

11,102. "Improvements in insulating material and in methods of manufacturing the same." THE BRITISH THOMSON-HOUSTON Co., LTD. (The General Electric Co., United States.) May 11th.

1,114. "Improvements in wireless telegraphy and telephony." E. R. CLARKE. May 11th.

11,149. "Improvements in electrical cables." BRITISH INSULATED AND HELSBY CABLES, LTD., and G. H. NISBETT. May 12th. (Complete.)

11,167. "Improvements in or relating to telephone and other electrical equipments for the use more particularly of divers." J. HOLMAN. May 12th.

11,177. "Improvements relating to electric fuses for firing guns." A. W. FELLOWES-GORDON. May 12th.

11,181. "Electro-magnetic automatic interrupter." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges. Germany.) May 12th. (Complete.)

11,182. "Improvements in electric switches." E. N. BRAY and BRAY, MARKHAM & REISS, LTD. May 12th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

PROTECTION OF ELECTRIC CIRCUITS FROM EXCESSIVE VOLTAGES. Siemens Bros. and Co. (Siemens Schuckertwerke Ges.) 2,794. February 8th.

ELECTRIC ARC LAMPS. British Thomson-Houston Co. (General Electric Co. 11,243. May 30th.

INSULATORS FOR ELECTRIC CONDUCTORS SUCH AS THE LIVE RAILS OF ELECTRIC TRACTION SYSTEMS. R. N. Redmayne. 11,344. May 30th.

ELECTRICAL PHASE INDICATORS AND OTHER INDUCTION INSTRUMENTS. M. B. Field. 12,491. June 15th.

COIN-FREED APPARATUS FOR THE SUPPLY OF GAS, ELECTRICITY AND THE LIKE. J. M. Tourtel. 13,430. June 29th.

ELECTRIC HOISTS SUITABLE FOR USE ON WARSHIPS. Clarke, Chapman & Co. and H. Walker. 13,577. July 1st.